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UNITED STATES NATIONAL MUSEUM

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UNITED STATES NATIONAL MUSEUM

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## ADVERTISEMENT

The scientific publications of the National Museum include two series, known, respectively, as *Proceedings* and *Bulletin*.

The *Proceedings*, begun in 1878, are intended primarily as a medium for the publication of original papers, based on the collections of the National Museum, that set forth newly acquired facts in biology, anthropology, and geology, with descriptions of new forms and revisions of limited groups. Copies of each paper, in pamphlet form, are distributed as published to libraries and scientific organizations and to specialists and others interested in the different subjects.

The dates at which these separate papers are published are recorded in the tables of contents of each of the volumes.

The present volume is the ninety-eighth of this series.

The *Bulletin*, the first of which was issued in 1875, consists of a series of separate publications comprising monographs of large zoological groups and other general systematic treatises (occasionally in several volumes), faunal works, reports of expeditions, catalogs of type specimens, special collections, and other material of similar nature. The majority of the volumes are octavo in size, but a quarto size has been adopted in a few instances in which large plates were regarded as indispensable. In the *Bulletin* series appear volumes under the heading *Contributions from the United States National Herbarium*, in octavo form, published by the National Museum since 1902, which contain papers relating to the botanical collections of the Museum.

REMINGTON KELLOGG,  
*Director, United States National Museum.*

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A REVISION OF SIX SUBFAMILIES OF ATHERINE  
FISHES, WITH DESCRIPTIONS OF NEW GENERA  
AND SPECIES

By LEONARD P. SCHULTZ

Among the fishes that I collected in 1942 in the Lago de Maracaibo Basin of Venezuela I found some aberrant silversides that were attracted to a light at night. In an endeavor to place these in the proper genus, I began a study of the American genera of silversides, using as a basis the 1919 review of the group by Jordan and Hubbs<sup>1</sup> and more recent papers by Dr. Hubbs. Soon it became apparent that an enormous amount of work still needed to be done on these fishes, especially on osteology, in order to clarify the status and relationships of the various genera of Atherinidae and that it would be necessary to include in my study all the genera of silversides, starting with the genotypes of each genus. Jordan and Hubbs' revision has served a most useful purpose for many years, but as new material became available for study it was inevitable that new characters would be discovered and new conclusions reached. I have found particularly that some of the genera said by them to be related are not closely related. Study of the significance of the extension of the air bladder into the haemal arches of the caudal vertebrae, neglected by most previous ichthyologists, has helped to clarify the picture in this family.

This study includes all the atherine fishes commonly known as silversides except the subfamilies Melanotaeniinae, Bedotiinae, and Rheoclinae. These subfamilies, which were recognized by Jordan and

<sup>1</sup> Jordan, David Starr, and Hubbs, Carl Leavitt, Studies in ichthyology: A monographic review of the family Atherinidae or silversides. Leland Stanford Junior Univ. Publ., Univ. Ser. [No. 40], 87 pp., 12 pls., 1919.

Hubbs, are distinguished by having nonpungent dorsal spines or first dorsal fin elongate, reaching the second, whereas the ones treated herein have pungent spines in first dorsal fin not reaching the second. The genus *Nannatherina* Regan, included in the silversides by Jordan and Hubbs, has been placed by Regan in the family Kuhlidae.

Although the phallostethid fishes have much in common with the atherinids, especially in fin structure, mouth parts, air bladder, and other features, on the basis of the present known differences I am of the opinion that the two families are distinct from each other, the Phallostethidae ranking among the Mugilidae, Atherinidae, Sphyraenidae, and possibly the Polynemidae. Among other characters, the specialization of the copulatory organs separates the Phallostethidae, which may be considered viviparous silversides.

The conclusions herein presented were made after several hundred lots of silversides, containing a few thousand specimens from most parts of the world, were examined. Despite this abundant material, most of which is in the United States National Museum, I have had difficulty in assigning the species to genera of concise definition, mainly because of the great complexity of the numerous kinds of silversides whose characters in many instances overlap. Inadequate descriptions in the literature have been very troublesome, especially in regard to genera that have been based entirely on external characters. No attempt is made to place under each genus all the species belonging there, since to do so would require the reexamination of the types scattered in museums around the world. The range of each genus as given in the key may be extended as various species are more thoroughly studied and referred to the genera herein characterized.

The classification that follows summarizes the subfamilies and genera treated in this paper. The arrangement of the subfamilies indicates relationships. The specialized condition of the air bladder and first few haemal arches may have evolved separately in the various subfamilies.

#### Family ATHERINIDAE

##### Subfamily ATHERININAE

Genus *Atherina* Linnaeus

Genus *Hepsetia* Bonaparte

Genus *Atherinason* Whitley

##### TAENIOMEMBRASINAE, new subfamily

Genus *Taeniomembras* Ogilby

Genus *Craterocephalus* McCulloch

*Stenatherina*, new genus

Genus *Alepidomus* Hubbs

Genus *Allanetta* Whitley

*Hypoatherina*, new genus

Genus *Pranesus* Whitley

Genus *Atherinomorus* Fowler

## ATHERIONINAE, new subfamily

Genus *Atherion* Jordan and Starks

## TROPIDOSTETHINAE, new subfamily

Genus *Notocheirus* ClarkGenus *Tropidostethus* OgilbyGenus *Iso* Jordan and Starks

## MENIDIINAE, new subfamily

Genus *Melanorhinus* MetzelaarGenus *Archomenidia* Jordan and HubbsGenus *Xenatherina* ReganGenus *Labidesthes* CopeGenus *Atherinella* SteindachnerGenus *Thyrinops* HubbsGenus *Melaniris* MeekGenus *Chirostoma* SwainsonGenus *Menidia* BonaparteGenus *Poblana* de Buen*Menidiella*, new genus*Xenomelaniris*, new genus*Adenops*, new genusGenus *Membras* BonaparteGenus *Eurystole* JordanGenus *Nectarges* Myers and WadeGenus *Coleotropis* Myers and WadeGenus *Hubbesia* Jordan

## Subfamily ATHERINOPSINAE

Genus *Austromenidia* HubbsGenus *Leuresthes* Jordan and GilbertGenus *Odontesthes* Evermann and KendallGenus *Hubbsiella* BrederGenus *Basilichthys* GirardGenus *Atherinopsis* GirardGenus *Atherinops* Steindachner

In glancing over the various genera referable to the subfamilies recognized in this revision, their distribution appears to be characteristic.

The subfamily Atherininae contains three genera occurring in the European region, the Mediterranean and Caspian Seas and possibly in nearby groups of islands, and the southern Australian region. I have had no material from the Canary Islands or from the coastal regions of Africa, where it may occur.

The subfamily Taeniomembrasinae contains eight known genera both salt and fresh water, mostly of tropical and subtropical distribution. They are found in Australia, the Central and Western Pacific and Indian Oceans, Japan, Atlantic Ocean from Africa to Bermuda, and the Western Atlantic from Florida, West Indian region, to Brazil. The fresh-water species of this subfamily occur in Cuba and in the Australian region.

The subfamily Tropidostethinae contains marine species in three known genera, all of which have been found occurring in the surf, from

Japan, India, Australia, Tasmania, the south and east coasts of South Africa, and Chile. Its range should be materially extended as more collecting is done in the ocean surf. Perhaps from an ancestral stock, represented by the Atherioninae, with the monotypic genus *Atherion*, the Tropicostethinae could have evolved. Both appear to prefer surf or near-surf conditions.

In the Menidiinae I have recognized 18 genera, fresh-water and marine, all of which are American. It too is a New World subfamily, ranging on the Atlantic side from Nova Scotia to Brazil and on the Pacific side from Mexico to Peru and the Galápagos Islands. The Menidiinae contain 18 genera with the most variable characters in any subfamily of the silversides, and these characters overlap somewhat among a few closely related genera. There are eight genera found only on the Atlantic side and seven on the Pacific. Three genera, *Melanorhinus*, *Thyrinops*, and *Coleotropis*, have species on both sides of Central America. Many of the genera in this family are peculiar to certain stream systems of the New World.

The Atherinopsinae are a New World subfamily containing seven known genera, six of which are confined to the Pacific coastal region ranging from Oregon to Mexico and from Peru to Patagonia. The other genus, *Odontesthes*, occurs from Argentina to Brazil. Both fresh-water and marine species are found in this American subfamily. So far none of the genera have been collected on the Atlantic or Pacific sides of Central America. Four genera occur from Oregon to Baja California and the Gulf of California, and the other three genera occur from Peru to Patagonia, the Falkland Islands northward to Brazil. As far as known, the subfamily is not tropical, occurring in the temperate and subtropical regions.

The New World forms the sole habitat of 28 genera of silversides and shares 1 additional genus, *Allanetta*, with the tropical Western Pacific and Indian Oceans and the tropical Atlantic Ocean. There remain 11 genera occurring in the Old World. Nine of these are found in the Western Pacific and Indian Oceans, leaving two for Europe and Asia Minor.

My key to the genera, though somewhat artificial in itself, is practical and defines the natural generic units as observed by me. Unfortunately, those who classify and base genera mostly on external characters will find this family a little too complex. Ichthyological studies must be increasingly more carefully done if the various genera are to be thoroughly understood. Though it is necessary to use certain internal structures, this method need not be too complex for practical purposes.

The premaxillary may be pulled forward to expose the nature of the ascending processes, and the tissues should be dissected off to expose



the sides and posterior end. The elevated processes or rami at the rear end of the mandibles are usually visible without dissection. The teeth must be examined by means of a microscope, since the old-time hand lens is of little use for the study of minute details and can be discarded as far as atherinids are concerned.

The length of the head is from the tip of the snout to its posterior fleshy edge; in counting the vertebrae I have used, for example, the formula 14+18, the 14 representing the abdominal and the 18 the caudal vertebrae. The first caudal vertebra is the one that gives rise to the first haemal arch, and this arises on the posterior part of the vertebra, thence extending ventrally under the next vertebra. In certain genera in the Atherinopsinae, where the haemal arch appears to form at about six or seven vertebrae in front of the enlarged hypophyses, I have counted as the first caudal vertebra the one bearing the first enlarged or broadened hypophysis. This appears to bring the counts for such genera as *Atherinops* and *Leuresthes* into line with the other genera. Scales were counted from the upper edge of the gill opening to the midbase of the caudal fin. In the fin-ray formula I use capital Roman numerals for spines, lower-case Roman numerals for unbranched soft rays, and Arabic characters for the branched soft rays; for example, IV-I, i, 10, the dash indicating that the first dorsal fin is separated from the second dorsal fin. In determining whether the lower jaw projects beyond the tip of the premaxillaries, I considered that it did if it extended beyond a vertical line through tip of snout. The maxillary was considered to extend past front of eye when its posterior tip was behind a vertical line through front of eye.

#### KEY TO GENERA OF ATHERINIDAE

- 1a. Head truncate posteriorly; pectorals placed high on body, upper part of base above silvery lateral band, if present (absent in *Melanorhinus*); body sharply compressed; anterior edge of premaxillary a little concave; anus located closer to anal origin than to base of pelvies, scarcely in an advanced position; rami of mandibles elevated; body cavity ending abruptly and not extending into haemal arches.
- 2a. Midventral line from in front of anal origin to between pelvic fins with a fleshy keel nearly of paper thinness; head with fine to coarse denticles anteriorly and ventrally; premaxillaries not protractile and not dilated posteriorly; ascending premaxillary process short and broad; silvery lateral band present; greatest depth of body equal to or more than length of head; vertebrae in two counts 14 to 18+25 to 28-- (subfamily TROPIDOSTETHINAE)
- 3a. Anterior as well as rest of body fully scaled; ventral keel scaled; spiny dorsal fin absent; pectorals almost entirely above silvery lateral band; front of head with conspicuous denticles; scales with denticles; dorsal rays about 17; anal about I, 29 (Valparaiso Harbor, Chile).

Notocheirus Clark
- 3b. Anterior part of body and head naked; ventral keel naked except for scales around anus; spiny dorsal present, small; pectoral bases about

as much above the silvery band as below it; front of head with small denticles; scales without denticles.

- 4a. Silvery lateral band fading and interrupted or narrowly constricted on caudal peduncle, then continuing and expanding, ending in a prominently enlarged silvery area (southern Australia, Tasmania, South Africa, and India) ----- *Tropidostethus* Ogilby

4b. Silvery lateral band continuous and not interrupted (Japan).

Iso Jordan and Starks

- 2b. Midventral line of abdomen without a fleshy keel as above although ventral edge is sharply compressed and fully scaled; head without denticles; premaxillaries protractile and expanded posteriorly; ascending process a narrow-based slender bony spinelike projection; silvery lateral band absent; greatest depth of body more than length of head; pelvic insertion notably closer to upper angle of pectoral fin base than to anal origin; axillary scale of pelvics exceedingly long, usually about two-thirds of eye; both dorsal and anal fins with a sheath of scales one row wide; origin of first dorsal far in advance of anus, nearly over tips of pelvics; anus just in front of anal origin; vertebrae in two counts 14+22 and 14+24 (Atlantic and Pacific sides of Central America and in Cuba and West Indies) (subfamily MENIDIINAE) ----- *Melanorhinus* Metzelaar

- 1b. Head not truncate posteriorly; pectoral not placed above silvery lateral band or notably high on body, usually opposite or below silvery lateral band; silvery lateral band normally present; midventral line of abdomen without fleshy keel, although ventral edge may be sharply compressed and scaled; head usually without denticles but if present in nearly parallel lines (*Atherion*); premaxillaries protractile or not protractile.

- 5a. Edge of premaxillary either straight or a little convex, gape of mouth not concave and posterior end of premaxillary not notably broadened or dilated; rictus scarcely restricted at corner of mouth by a membrane folding between jaws; anus notably in advance of anal origin; anal-fin origin always far behind first dorsal origin; pelvic fins inserted notably closer to pectoral base than anal origin; ascending premaxillary process meeting its fellow along midline, at least basally; teeth in villiform bands, sometimes reflected on outer face of premaxillary as "shagreen."

- 6a. Air bladder or body cavity tapering to a point posteriorly, and extending into three to six of the haemal arches, which have more or less broadened hypophyses opposite the air bladder (figs. 1b and 1c); no denticles or spinules; one or two short lateral processes on premaxillary in addition to ascending terminal one; origin of first dorsal closer to tip of snout than to caudal fin base; scales if present on base of pectoral small, not enlarged; rami of mandible elevated (see pls. 1, 2).

(subfamily ATHERININAE)

- 7a. Air bladder extending into five or six of the broadened haemal arches, the latter not connecting by a bony platelike process with the following arch; anus behind tips of pelvics, closer to anal origin than to pelvic bases.

- 8a. Anterior ascending premaxillary process long and slender, reaching past front of orbits; vomer and palatines without teeth; middorsal ridge obvious just behind rear of head (southern European region) ----- *Atherina* Linnaeus

- 8b. Anterior ascending premaxillary process broad, not reaching past front of orbit; vomer and palatines with obvious but small teeth; no middorsal ridge behind head (southern European region).

*Hepsetia* Bonaparte

- 7b. Air bladder extending opposite three of the broadened haemal spines and connecting with next haemal arch by a bony platelike process; anus in front of tips of pelvic fins, much closer to pelvic bases than to anal origin; anterior ascending premaxillary process long and slender reaching past front of orbits; teeth on vomer present or absent; middorsal ridge scarcely evident behind head; maxillary reaching past front of eye; scales small about 70 to 75; posterior margin of scales angular or somewhat pointed (southern Australian region)-----*Atherinason* Whitley
- 6b. Air bladder or body cavity ending bluntly just in front of anal origin, not entering first haemal arch; none of haemal spines or hypophyses broadened (fig. 1a)-----(*TAENIOMEMBRASINAE*, new subfamily)
- 9a. Gill rakers tuberculate, fewer than 12 on lower part of first arch; premaxillary process moderately long, about equal to or a little longer than diameter of pupil; mouth small, maxillaries notably not reaching to a vertical line through front of orbits; teeth at front of both jaws somewhat enlarged, conical, those on premaxillary in one row and on dentary in two irregular rows; lips at corner of mouth fused about one-third the way toward tip of premaxillary; anus in front of tips of pelvic fins-----*Craterocephalus* McCulloch
- 9b. Gill rakers long to moderately long, slender, not tuberculate, more than 12 on lower limb of first gill arch.
- 10a. Ascending premaxillary process long, slender, notably longer than diameter of pupil, equal or nearly equal to diameter of eye, reaching considerably into interorbital space, a shorter process or spine-like projection on side of premaxillary (fig. 2b); rami of mandibles elevated; premaxillary dentition not reflected as shagreen on outer face of this bone; soft rays of dorsal, anal, and pectoral fins without scaly sheath; teeth in both jaws in a narrow villiform band; maxillary reaching or nearly reaching a vertical line through front of orbit; first dorsal origin about equidistant or a little closer to tip of snout than to midbase of caudal fin; scales on opercle and on pectoral base greatly enlarged; one row of scales below eye; teeth on vomer; anus behind tips of pelvic fins-----*Stenatherina*, new genus
- 10b. Ascending premaxillary process short, broad based, about equal to or shorter than pupil, not notably extending into interorbital space.
- 11a. No scales on shoulder girdle below pectoral base; opercular scales probably absent; no concavity on bony edges of preopercle; no sheath of scales along base of anal fin and no scales on bases of dorsal or pectoral fins; posteriorly the rami of mandibles inside mouth not elevated; lower jaw a trifle longer than upper; distal margins of soft dorsal and anal fins notably concave; vertebrae in one count 15+21 (fresh waters of Cuba)-----*Alepidomus* Hubbs
- 11b. Scales present and greatly enlarged on shoulder girdle below pectoral base; opercular scales greatly enlarged.
- 12a. Posteriorly the rami of mandibles are distinctly elevated (figs. 3c and 3f).
- 13a. Posterior margin of anterior bony edge of preopercle truncate, without concavity, a short but distinct lateral process on premaxillary; anus between pelvics (Australian region).  
*Taeniomembras* Ogilby

13b. Posterior margin of anterior bony edge of preopercle with a concavity near its lower corner.

14a. Anus in front of tips of pelvic fins, usually in front of first dorsal origin (central tropical Pacific westward to Africa and tropical western Atlantic) — *Allanetta* Whitley

14b. Anus behind tips of pelvic fins and under base of spiny dorsal fin (central tropical Pacific westward to Africa).

*Hypoatherina*, new genus

12b. Rami of mandibles not elevated (figs. 3d and 3e).

15a. Bases of dorsal, anal, and pectoral fins naked (central and western Pacific and Australian region) — *Pranesus* Whitley

15b. Bases of dorsal, anal, and pectoral fin rays with scales (western Atlantic from Florida to Brazil).

*Atherinomorus* Fowler

5b. Edge of premaxillary concave or gape of mouth concave and premaxillaries notably dilated or broadened posteriorly (figs. 4a-e); rictus more or less restricted at rear corner or side of mouth by a membrane folding between jaws; anus usually close in front of anal origin or far in advance of it in *Archomenidia* and *Adenops*; anal fin origin behind or in front of first dorsal fin origin; pelvics usually inserted a little closer to anal origin than to upper edge of pectoral base except in *Adenops* and *Atherion*; ascending premaxillary processes of two types: If spinelike, not meeting its fellow along midline except at tips; if short and broad-based, meeting along midline.

16a. Spinules in more or less parallel rows on head and especially on under side and in front of eye; premaxillary and dentary with shagreen-like denticles covering their outer surfaces; air bladder and body cavity ending bluntly in front of anal origin and not extending into haemal arches; anus just in front of anal fin origin, scarcely advanced in position; first dorsal origin a little in front of a vertical line through anus and slightly closer to tip of snout than to caudal fin base; mouth small, maxillary not reaching orbit; rami of mandibles strongly elevated; ascending premaxillary process a short, broad, truncate, platelike projection, no lateral processes on premaxillary (fig. 2g); vertebrae 16 or 17+24 or 25; vomer with minute teeth, palatines probably edentulous (Japan to Marshall Islands southward to Lord Howe Island) (subfamily *ATHERIONINAE*) — *Atherion* Jordan and Starks

16b. No spinules on head in rows; teeth in rows, conical, enlarged and canine-like or in villiform bands but never reflected on outer surface of premaxillary or on dentary as "shagreen."

17a. Air bladder tapering to a point posteriorly and extending into five or more of haemal arches and five or more of first caudal vertebrae with broadened hypophyses, these broadened hypophyses mostly interconnecting with one another by flattish posteriorly projecting bony processes, opposite tapering posterior part of air bladder; vertebrae in increased number ranging from about 24 to 33+18 to 30 — (subfamily *ATHERINOPSINAE*)

18a. Premaxillary protractile, not bound firmly to tip of snout by a frenum; ascending bony process of premaxillary with narrow base, not triangular in shape, and more or less separated at anterior midline by a cartilaginous or fleshy rod (figs. 4a, 4d); margins of scales rough or entire.

- 19a. Scales small in more than 68 rows from upper edge of gill opening to midbase or caudal fin; scaly sheath at base of anal present or absent; more than 15 rows of scales between dorsal origins; either no teeth on vomer or a very few minute ones that can be felt with a needle or seen under magnification.
- 20a. Origin of first dorsal far in advance of anal origin and in front of a vertical line through anus; no scaly sheath along base of anal fin or at least not more than a few scales at anal origin; base of last ray of second dorsal over, a little behind, or a little in front of base of last anal ray; posterior margin of scales entire or slightly crenulate; teeth in jaws in outer row a little enlarged, inner row of minute teeth single or in a narrow irregular band; sometimes a few scales at anterior part of interorbital space are reversed in imbrication; vertebrae in four counts 24 to 28+23 to 30 (Peru to Patagonia, Juan Fernández and Falkland Islands along coast and in fresh waters)-----*Austromenidia* Hubbs
- 20b. Origin of first dorsal a little behind origin of anal fin; a well-developed scaly sheath along base of anal fin; base of last ray of second dorsal notably in advance of base of last anal ray or over about fifth from last anal ray; posterior margin of scales strongly crenulate; teeth minute, microscopic, or lacking, if present in a narrow villiform band; no scale in interorbital space reversed in imbrication; vertebrae in two counts 29+20 to 22 (San Francisco Bay to Baja California)-----*Leuresthes* Jordan and Gilbert
- 19b. Scales larger in fewer than 60 rows from upper edge of gill opening to midbase of caudal fin; origin of first dorsal between a vertical line through anal origin and one through anus; sheath of scales along anal base confined to a small group at anterior part of base of that fin; 7 to 9 rows of scales between dorsal origins; base of last ray of second dorsal behind base of last anal ray; about 25 to 30 gill rakers on lower limb of first gill arch.
- 21a. Teeth in both jaws enlarged, rows rather widely spaced but sometimes irregular; teeth on vomer more or less well developed, obsolete in young; snout more or less pointed, somewhat pikelike in *perugia*; premaxillaries moderately protractile; margins of scales entire; dorsal rays IV-I, i, 7 to VII-I, i, 10; anal rays I, i, 13 to 16; vertebrae in two counts 26 or 27+22 to 23 (Atlantic coasts from Brazil to Argentina in fresh waters)-----*Odontesthes* Evermann and Kendall
- 21b. Teeth minute in about two rows on jaws; possibly minute teeth on vomer, but none on palatines; snout not pointed; premaxillaries excessively protractile as in *Leuresthes tenuis*; margins of scales rough or entire; dorsal rays VI-I, i, 8; anal I, i, 21; scales 54 to 56; vertebrae in one count 29+20 (Gulf of California)-----*Hubbsiella* Breder
- 18b. Premaxillary not protractile, connected to tip of snout by a frenum; ascending premaxillary process a short broad-based triangular plate, not spinelike; posterior margin of scales entire; origin of first dorsal over anus or a little in advance of a vertical line through anus.

- 22a. Scales on dorsal surface of head reversed in imbrication as far posteriorly as a line connecting across rear of orbits; base of last ray of dorsal a little behind base of last anal ray; scales small, in very numerous rows; a small patch of teeth at head of vomer sometimes present; teeth in jaws in a band, outer row slightly enlarged; vertebrae in two counts 26 to 29+21 (Peru and Chile in streams and probably in salt waters).

**Basilichthys Girard**

- 22b. Scales, if present, on dorsal surface of head not reversed in imbrication, but normal; base of last ray of second dorsal about over base of first to third from last anal rays.
- 23a. Teeth conical-pointed, in two or three rows on jaws; first dorsal of VII to IX spines; snout somewhat pointed, jaws about equal; vertebrae in one count 33+18 (California to Baja California in salt water)-----**Atherinopsis Girard**
- 23b. Teeth with bifid tips, in a single row on jaws; first dorsal of IV to VII spines; tip of snout broadly rounded, extending a little in front of upper lip, so that tip of snout is a little anterior to bifid teeth; vertebrae in one count 28+20 (coasts from Oregon to Baja California and offshore islands; also Gulf of California)-----**Atherinops Steindachner**
- 17b. Air bladder not tapering to a point posteriorly and not extending into five or more of the haemal arches, the latter not modified as above [sometimes extent of body cavity may be observed by placing fish in front of a very bright light]; vertebrae about 13 to 23+18 to 27----- (subfamily MENIDIINAE)
- 24a. Posterior end of body cavity extending to opposite anal origin or well past anal-fin origin; air bladder not extending past second haemal arch.
- 25a. Anus far in advance of anal-fin origin, as close to or closer to pelvic bases than to anal origin; scales not lacking on head or on body; a sheath of scales, anteriorly at least, along base of anal fin; first dorsal origin over or slightly in advance of anal origin; pelvic insertions equidistant between anal origin and upper angle of pectoral fin base; maxillary not quite extending to a vertical line through anterior margin of eye; teeth of outer series stronger and more regular than inner series; when mouth is closed outer premaxillary teeth somewhat exposed and directed outward; dorsal and anal fins falcate; vertebrae in one count 22+18; ascending process of premaxillary a short, broad-based triangular plate, meeting along midline; no glandularlike depressions on dorsal surface of snout; axillary scale of pelvic fins well developed; margins of scales entire or slightly scalloped; scales 40 to 42; dorsal rays IV or V—I, i, 8 or 9; anal rays I, i, 16 to 18 (east-coast streams of central Mexico).

**Archomenidia Jordan and Hubbs**

- 25b. Anus usually just in front of anal-fin origin, always closer to anal origin than to pelvic fin bases.
- 26a. Scales lacking on head, on shoulder girdle in front of pectoral fin base, and on anterior part of body, except a few rows may extend forward a little between the naked areas; ascending premaxillary process a broad-based triangular

plate; no scaly sheath along anal base; first dorsal origin behind a vertical line through anal-fin origin, about over base of third branched anal ray; pelvic insertions a little closer to anal origin than to upper angle of pectoral base; maxillary reaching to under eye, nearly or quite to below front of pupil; base of last ray of second dorsal a trifle behind base of last anal ray; teeth in an irregular narrow band with some a little enlarged and a few somewhat pointing forward along outer face at front of premaxillary; vertebrae in one count 16+23; body somewhat compressed ventrally (east-coast streams of Veracruz, Mexico).

**Xenatherina Regan**

26b. Scales normally present on anterior part of head and body or, if there is a tendency for scales to be lacking on head and in front of base of pectoral fin, ascending premaxillary processes spinelike and not broad-based triangular plates.

27a. Jaws produced into an angular beak; lower jaw a little longer than upper or equal to it, with exposed part of premaxillary at front of snout long, equaling two-thirds interorbital space; ascending premaxillary process a broad-based triangular plate (fig. 4b); anus closer to anal origin than to pelvic base; origin of first dorsal a little behind anal origin; teeth conical, in two rows anteriorly, one row along sides; no sheath of scales along anal fin base; base of last ray of second dorsal over base of fourth from last anal ray; margin of scales entire; anus just in front of anal origin; vertebrae in one count 20+21 (fresh waters of eastern North America northward to southern Michigan and Lake Ontario).

**Labidesthes Cope**

27b. Upper jaw rounded, not beaklike, or if upper jaw is angular and somewhat pointed, lower jaw projecting; ascending premaxillary process a narrow-based, bony, spinelike projection or a broad-based triangular plate; anus located just in front of anal origin or much closer to anal origin than to pelvic insertions.

28a. Origin of first dorsal fin notably behind anal origin, at least over or behind base of second branched anal-fin ray; belly sharply compressed or somewhat rounded.

29a. Origin of first dorsal fin over middle of length of anal-fin base; belly sharply compressed, carinate; pectoral fins about one and a half length of head; posterior margins of scales dentate; two rows of scales below eye; no scaly sheath along base of anal fin (west coast of Panama)-----**Atherinella Steindachner**

29b. Origin of first dorsal fin over front of anal-fin base, notably in front of middle of length of anal-fin base, but over or behind base of second branched anal ray; belly compressed or rounded, not carinate.

30a. Ascending premaxillary process a narrow-based spine-like projection, not triangular; lower jaw included or nearly equal; belly somewhat compressed; a sheath of scales along anal-fin base for its entire



length or sometimes only a few scales anteriorly (in poorly preserved specimens scaly anal sheath may be lacking); four glandlike depressions on top of snout, sometimes indistinct in poorly preserved specimens and represented by pores in *T. colombiensis*; scales with posterior margins dentate, weakly crenate (except in the young the scale margins entire, or in adults of certain species margins entire except for a row or so of crenulate scales along middorsal line); teeth in outer row a little enlarged, then a narrow band of villiform teeth inside; vertebrae in several counts 18 to 20 + 19 to 22 (marine, west coast of Mexico to Panama Bay and in fresh waters of Mexico to Central America; also Atlantic side of Guatemala to Panama in streams).

**Thyrinops** Hubbs

- 30b. Ascending premaxillary process short, broad-based, and triangular in shape; lower jaw equal to or a trifle longer than upper jaw, not included; belly rounded; no sheath of scales along anal-fin base; no glandlike structures on snout as in 30a; margins of scales entire; teeth in outer row somewhat enlarged, conical, followed by a widely spaced inner row on lower jaw, but on upper jaw inner teeth irregular or in a narrow villiform band; vertebrae in two counts 15 or 16 + 22 or 23 (Río Balsas, Guerrero, west coast of Mexico) ----- **Melaniris** Meek
- 28b. Origin of first dorsal notably in front of anal origin to over base of first branched ray of anal fin; belly rounded.
- 31a. Lower jaw usually angular, somewhat pointed at tip, longer than upper, notably projecting in front of tip of snout when mouth is closed; front tip of premaxillaries angular, more or less pointed; body cavity extending notably past anal origin, at least beyond base of third branched anal ray; margins of scales entire or crenulate; no scaly sheath along base of anal fin; ascending bony process of premaxillaries usually narrow-based and elongate or spinelike, with a V-shaped space between them; teeth in both jaws in two or three irregular rows, conical, sometimes enlarged; vertebrae in several counts 19 to 23 + 18 to 24 (fresh waters of Río Lerma Basin and Valley of Mexico).

**Chirostoma** Swainson

- 31b. Lower jaw a little longer than upper or a little shorter or included, not angular but with rounded tip; front tips of premaxillaries rounded; body cavity extending to opposite anal-fin origin or to base of fifth branched anal ray in *Menidia extensa*; margins of scales entire or very weakly crenulate.
- 32a. Lower jaw equal to or slightly longer than upper jaw; ascending premaxillary process a narrow-based spinelike projection; posterior margin of premaxillary bone convex or rounded; origin of first dorsal



fin in advance of anal-fin origin; pelvic axillary scale, if present, very small, not over two-thirds diameter of pupil.

- 33a. Postorbital length of head contained more than twice in length of anal-fin base; scales normally formed on anterior part of body and in front of pectoral-fin base; teeth of outer and inner rows about of equal size, a little enlarged; vertebrae 17 to 21+19 to 27; no scaly sheath along base of anal fin; greatest depth of body  $4\frac{1}{2}$  to 7 times in standard length; soft rays of anal fin 13 to 28 (Nova Scotia to mouth of Rio Grande, Tex., in fresh and salt waters)-----*Menidia* Bonaparte
- 33b. Postorbital length of head contained 1 to  $1\frac{2}{3}$  times in length of anal-fin base; teeth minute in a narrow band in both jaws; greatest depth of body  $2\frac{9}{10}$  to  $5\frac{1}{2}$  times in standard length.
- 34a. Scales lacking in front of base of pectoral fin and irregularly lacking on head and on front part of body; vertebrae in one count 16+22; no scales along base of anal fin; soft rays of anal fin 13 to 16 (fresh water, Laguna de Alchichica, Puebla, Mexico)-----*Poblana* de Buen
- 34b. Scales normally formed on head, body, and in front of base of pectoral fin; vertebrae in one count 14+18; two or three scales at front of anal-fin base forming a rudimentary sheath anteriorly; soft rays of anal fin 9 to 14 (Key West, Fla., and Yucatán)----*Menidiella*, new genus
- 32b. Lower jaw included, a little shorter than upper jaw; ascending premaxillary process moderately broad-based but forming an elongate triangular platelike projection, usually longer than pupil; posterior margin of premaxillary angular (fig. 4c); origin of first dorsal fin over or nearly over anal origin, sometimes over base of first branched anal-fin ray; axillary scale of pelvic fin three-fourths diameter of eye; vertebrae in three counts 17 or 18+20 to 23; teeth in outer row of upper jaw enlarged, consisting of 6 to 10 widely spaced ones at front of jaw, within this outer row a narrow band of villiform teeth; teeth of lower jaw similar but more numerous than in outer row (Venezuela to Brazil, in fresh, brackish, and salt waters)-----*Xenomelaniris*, new genus
- 24b. Air bladder or posterior end of body cavity notably not reaching anal-fin origin.
- 35a. Dorsal surface of snout with four shallow glandlike depressions; anus far in advance of anal-fin origin; origin of first dorsal fin over anal origin or in front of it; ascending premaxillary process a narrow-based, elongate, spinelike projection (fig. 4e); a scaly sheath present, at least anteriorly along anal-fin base;

axillary scale of pelvics present; teeth minute in a narrow villiform band on both jaws; mouth small, maxillary not reaching to opposite orbit; scale margins entire or crenulate.

- 36a. Vertebrae usually 14 to 16+22 to 26; anus in middle third of length between anal origin and pelvic bases or closer to pelvic bases than anal origin, at tips of pelvic fin rays or in front of their tips; origin of first dorsal notably in advance of a vertical line through anal origin; pelvic insertions about equidistant between anal origin and upper angle of pectoral fin base (Lago de Maracaibo, and Colombia on Atlantic side) ----- **Adenops**, new genus

- 36b. Vertebrae usually 18 to 20+23 to 25; anus in front of anal origin a distance of about one-fourth the way to pelvic bases, notably behind tips of pelvic rays; origin of first dorsal over anal origin or a trifle in advance of it; pelvic insertions closer to anal origin than upper angle of pectoral fin base (New York to Florida and Gulf coast of Mexico and West Indies).

**Membras Bonaparte**

- 35b. Dorsal surface of snout without four glandlike depressions; anus more than three times closer to anal origin than to pelvic-fin bases, usually just in front of anal-fin origin; pelvic insertions midway between anal origin and some point on pectoral-fin base or closer to anal origin.

- 37a. Vertebrae 13 or 14+24 to 27 (based on three counts); posterior margins of scales entire; belly somewhat compressed; ascending premaxillary process a broad-based, short, triangular-shaped platelike bony projection; anal-fin origin much closer to middle of length of head than to caudal-fin base; scaly sheath present at least anteriorly along base of anal fin.

- 38a. Origin of first dorsal fin slightly behind or over anal-fin origin; teeth in a narrow band on jaws in two or three rows.

- 39a. Anal fin with 3 to 8 small scales in a single row along anterior base of anal fin; silvery lateral band constricted to a line on caudal peduncle and broadening again into a triangle at caudal base; scales in a lateral series from upper end of gill opening to hypural fan 38 to 40; predorsal scales 13 to 16; scales around caudal peduncle 12; maxillary reaching vertical of a point about midway between anterior border of orbit and anterior border of pupil when mouth is tightly closed; vertebrae in one count 13+24 (Gulf of California to Peru) ----- **Eurystole** Jordan

- 39b. Anal-fin base with a wide scaly sheath of two rows in width along most or all of its length; silvery lateral band scarcely or only very slightly constricted on caudal peduncle, never constricted to a thin line; scales in lateral series 58 to 65; predorsal scales 23 to 28; scales around caudal peduncle 16 to 18; maxillary not or barely reaching vertical of front edge of orbit when mouth is tightly closed; vertebrae in one count 14+26 (Gulf of California to Peru and Galápagos Islands).

**Nectarges Myers and Wade**

38b. Origin of first dorsal over bases of fourth or fifth branched rays of anal fin; teeth pointed, a little enlarged, in two rows on jaws; anal-fin base with a wide scaly sheath composed of two rows of scales along its entire length; silvery lateral band somewhat constricted on caudal peduncle, bordered above with a dark line; scales 39 to 40 from upper edge of gill opening to midbase of caudal fin; predorsal scales about 18; scales around caudal peduncle 12 to 16; maxillary reaching to below front part of eye; vertebrae in one count 14+27 (Pacific side of Panama and Atlantic from Gulf of Venezuela to Brazil).

Coleotropis Myers and Wade

37b. Vertebrae 18 to 21+25 or 26 (based on three counts); posterior margins of scales crenulate; belly rounded or slightly compressed; ascending premaxillary process a narrow-based spinelike projection; anal-fin origin much closer to caudal-fin base than to rear edge of head; no scaly sheath along base of anal fin; silvery lateral band somewhat constricted on caudal peduncle; origin of first dorsal fin in front of anal origin, nearly over anus; base of dorsal without scaly sheath (Pacific, from Gulf of California to Panama)-----Hubbesia Jordan

### Subfamily ATHERININAE

This subfamily as previously understood by authors must be further restricted in the light of information evolved in the present study. This restriction should have been made by Jordan and Hubbs in their review, especially since Clementina Borsieri furnished such beautiful illustrations of the modified vertebrae and premaxillaries in the *Annali di Agricoltura* 1902, No. 233, pls. 6-10, 1904, to which they refer. Parts of these plates are herein reproduced (pls. 1, 2).

The subfamily Atherininae, as here restricted, includes those silversides with the posterior part of the premaxillary not dilated or notably broadened, that have the air bladder tapering to a point posteriorly and entering about three to six of the haemal arches, the latter with broadened hypophyses. Species referable to this group of which I have examined specimens came from the coasts of France, Italy, Greece, and the Caspian Sea and southern Australia. Undoubtedly the subfamily is not confined to the Mediterranean and Caspian Basins, and the southern Australian region and its range should be extended as species not available to me are studied. I do not know whether this type of silversides occurs in the Red Sea. There is no evidence of any kind that the Atherininae as here restricted occur in American waters as I have examined the vertebral column in all the American species of silversides heretofore referred to that subfamily.

In view of the similarity of the ascending premaxillary processes in the various species referable to this subfamily, it may be shown on

fresh material that the tooth characters used in my key are of no significance. In that case *Hepsetia* will be relegated to the synonymy of *Atherina*. However, since *Atherina hepsetus* shows extreme development of the ascending premaxillary process, I am tentatively recognizing *Atherina* as distinct from *Hepsetia*.

The first attempt to break up the all inclusive genus of *Atherina* Linnaeus was that of Bonaparte in *Iconografia della fauna italica*, volume 3, Pesci, in which he states:<sup>2</sup>

#### ATHERINA HEPSETUS

We shall divide the *Atherinides* into three classes, calling them *Atherina*, *Membras* and *Menidia*. The germ of this classification is to be found in the great work on fishes, continued by Prof. Valenciennes alone, and embodying the materials which he gathered under the guidance of his immortal teacher.

The first of these classes (*Atherina*) is characterized by the dorsal forefin being placed above the ventral ones and by the fact that [the fish's] mouth, cleft as far back as directly under the eye, is supplied with teeth, although exceedingly small, even on the palate.

The second class is distinguished by the fact that the first dorsal fin is placed above the anal one; the fish's mouth is obliquely cleft as far as the eye, the palate is toothless.

The third class, beyond having the dorsal forefin placed far back, is eminently distinguished by the fact of having a more horizontal mouth, cleft only down to the middle of the snout. All these features, jointly with the smallness of the eye, result in a different physiognomy. The palate is smooth and toothless.

The larger species clearly present a very singular characteristic trait which, in reality, brings them in proximity to the mullets, which are the only fishes possessing such a trait. The bones constituting the jaw are extremely slim; the back section of the maxillary bone, instead of becoming broader close to the angle of juncture, ends in a thin point.

Leaving aside the genera *Membras* and *Menidia*, formed exclusively of exotic species, we shall restrict ourselves to the *Atherina*, a cosmopolitan genus, in which all the Italian species are included. These genuine Atherinae may also, should we wish to be rigorous, be subdivided into two subgenera, which, by restoring the nomenclature established by Rondelez, we shall call *Hepsetia* and *Atherina*; forasmuch as (as the above-mentioned Valenciennes remarks) some species, among which we may instance the only European one, i. e., *Atherina boyeri* (*Hepsetus*, according to Rondelez, possess visible teeth both on their jaws and on their vomer and palatine bones; their head is broad and flat, their eyes large, their first dorsal fin small and corresponding to the terminal tip of the ventral fins; whereas other species, as in particular our *Atherina hepsetus* with a more pointed snout (*Atherina*, in Rondelez's nomenclature), possesses such small teeth as to be almost inconspicuous; their dorsal forefin is rather large and corresponding to the center of the pectoral fins. It does not, however, seem necessary to establish two subgenera for such species which can hardly be discerned by the keen zoologist's eye; nor could one absolutely separate them, except for the fact that the forms of our proposed *Hepsetia* are to be found, in exaggerated proportions, in foreign types. Nevertheless, we are exhibiting in a globe four species of Italian Atherinae which are the only ones whose existence

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<sup>2</sup> Translation by Dr. Elio Granturco, research assistant, Foreign Law Section, Library of Congress, to whom I extend my sincere thanks for this courtesy.

we have been able to ascertain, being unable to admit the existence of other species purely on the word of other scientists. Common to all four [species], nay, to all the known species of that genus, as we have delimited it, are the following characteristics.

Thus there can be no doubt that Bonaparte retained the genus *Atherina* and restricted it to European species. He definitely indicates that *Atherina hepsetus* is the species on which he based his diagnosis of the genus *Atherina*. This is in conformity with *Atherina* Linnaeus, with the genotype—*Atherina hepsetus* Linnaeus.

There is left the genus *Hepsetia* Bonaparte, and again the genotype is definitely indicated as *Atherina boyeri*.

I have carefully studied several lots, including numerous specimens of both species, *A. hepsetus* and *A. boyeri*, from the Bonaparte collection in the National Museum and find that the two species are in the same phyletic line.

There remain, after excluding *Atherina* and *Hepsetia*, a large number of generic names proposed for species of silversides previously under the catch-all genus *Atherina*. Among these I fail to find a single species in which the air bladder enters the haemal arches as in the subfamily Atherininae. All of them have the air bladder and body cavity similar to the drawing as shown in figure 1a.

The first genus named that belongs to this latter group is *Taeniomembras* Ogilby, 1898, with the genotype *Atherina microstoma* Günther from the Australian region, and these genera all belong to another subfamily, herein recognized as the Taeniomembrasinae, new subfamily.

The above discussion is not in full agreement with Dr. Jordan's note in Copeia, No. 32, pp. 47–48, 1916, entitled "On *Hepsetia* Bonaparte, a Forgotten Genus of Atherinoid Fishes." *Membras* is not a synonym of *Atherina*.

### Genus ATHERINA Linnaeus

PLATES 1, 2; FIGURES 1c, 2f

*Atherina* LINNAEUS, Systema naturae, ed. 10, p. 315, 1758 (genotype: *Atherina hepsetus* Linnaeus). (Internat. Comm. Zool. Nomenclature 1922, opinion No. 75.)

*Aphia* RISSO, Histoire naturelle des principales productions de l'Europe méridionale . . . , vol. 3, p. 287, 1826 (genotype: *Aphia meridionalis* Risso). The species described is not in sufficient detail to know with certainty if it should be referred to *Hepsetia* or *Atherina*, but it probably belongs as a synonym of *Atherina*.

Borsieri recognized five species from the Mediterranean region, but I refer only *Atherina hepsetus* with certainty to this genus. Probably *Atherina presbyter* Cuvier and Valenciennes belongs in this genus too.

The generic diagnosis is based on several specimens of *A. hepsetus* in the National Museum.

Genus *HEPSETIA* Bonaparte

PLATES 1, 2; FIGURES 1b, 2a, 2c, 3a, 3g

*Hepsetia* BONAPARTE, Iconografia della fauna italica . . . , vol. 3, Pesci, fasc. 91, 1836 (genotype: *Atherina boyeri* Risso).

Among the five species recognized by Borsieri I refer *Atherina boyeri* Risso, *A. mochon* Cuvier and Valenciennes, and *A. rissoi* Cuvier and Valenciennes to this genus.

The generic diagnosis is based on several specimens of *A. boyeri* in the National Museum.

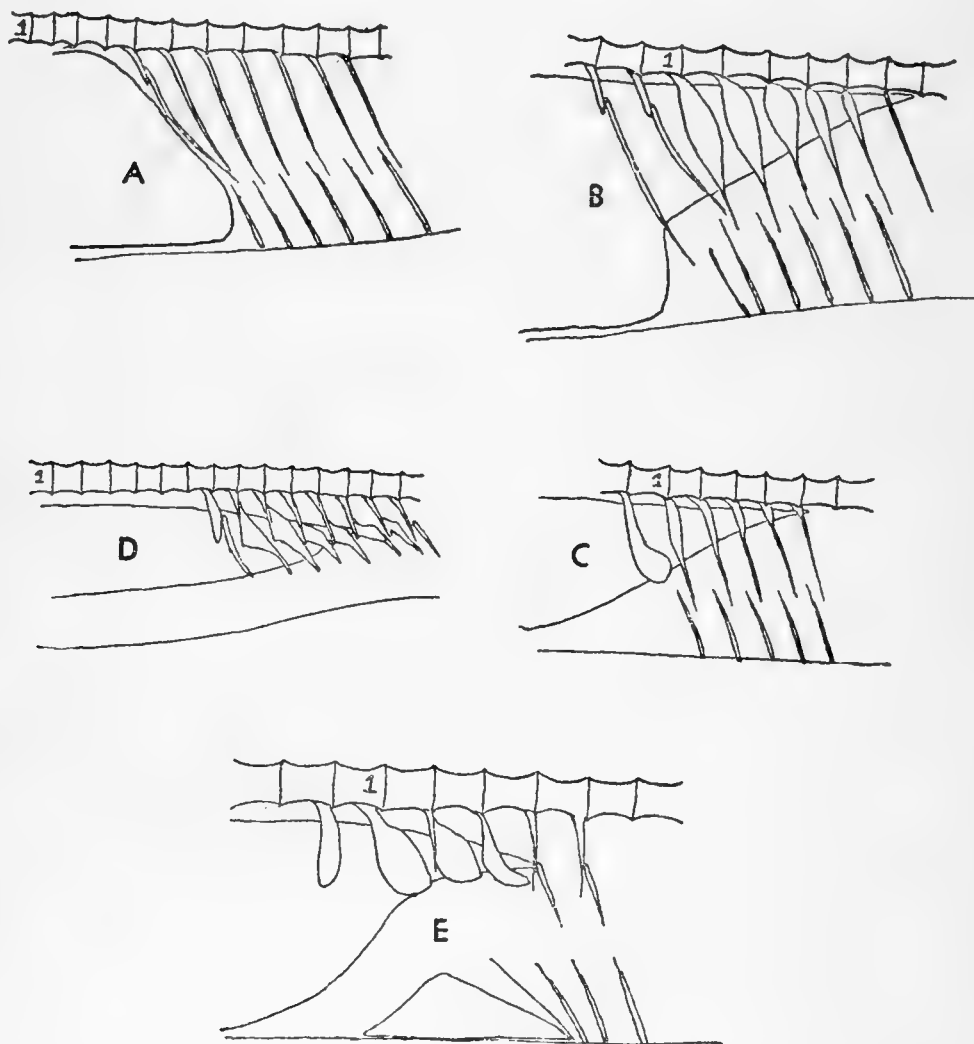


FIGURE 1.—Diagrammatic sketches of the posterior end of the body cavities of certain species of Atherinidae, showing the posterior end of the air bladder and the bones forming the haemal arches: *A*, *Stenatherina temminckii* (Bleeker), based on U.S.N.M. No. 136763 from the Philippines; *B*, *Hepsetia rissoi* (Cuvier and Valenciennes), based on U.S.N.M. Nos. 10088 and 121859 from Europe, Bonaparte collection; *C*, *Atherina hepsetus* Linnaeus, based on U.S.N.M. No. 10157 and 45503 from the Mediterranean, Bonaparte collection; *D*, *Atherinops affinis* (Ayres), based on U.S.N.M. No. 125271 from California; *E*, *Atherinason dannevigii* (McCulloch), from specimens from Port Hacking, New South Wales, and from Kangaroo Island, southern Australia, sent by Dr. Ian S. R. Munro.

## Genus ATHERINASON Whitley

## FIGURE 1c

*Atherinason* WHITLEY, Victorian Nat., vol. 50, No. 10, p. 241, 1934 (genotype: *Atherina dannevigii* McCulloch, Zool. Results *Endeavour*, vol. 1, pt. 1, p. 31, pl. 16, fig. 2, 1911).

This genus is monotypic and comes from Spencers Gulf, South Australia, and Oyster Bay, Tasmania. I have studied several specimens and the diagnosis is based on them and the descriptions by McCulloch. In four counts the first dorsal was VIII, the second dorsal I, i, 9 in one, I, i, 10 in three, and the anal was I, i, 11 in four.

## TAENIOMEMBRASINAE, new subfamily

Now that the Atherininae are restricted to the European silversides and one Australian genus that have the air bladder tapering to a point posteriorly and entering three to six haemal arches with broadened hypophyses, there remains a group of genera, previously referred to the Atherininae, that are without a subfamily name. This is easily remedied by assigning the new name Taeniomembrasinae to that group of genera with straight or convex anterior edges of premaxillaries, whose posterior tips are not broadened or dilated, and the air bladder and vertebrae are not modified as above. Thus restricted this subfamily includes a variety of genera in the Atlantic and Pacific Oceans, and probably westward across the Indian Ocean to the east Coast of Africa, although I have not examined any specimens from the Indian Ocean.

Although Hubbs (Occ. Pap. Mus. Zool. Univ. Michigan, No. 488, pp. 1-10, 1944) discusses recent generic divisions of the all-inclusive genus *Atherina* Linnaeus and proposes a new one, *Alepidomus*, his treatment of this group did not reveal the distinctive nature of the vertebrae and air bladder in the genera *Atherina*, *Hepsetia*, and *Atherinason*. Gilbert P. Whitley, in his generous naming of new genera, apparently relied largely on hunches rather than on careful diagnosis, leaving to later ichthyologists the complicated task of making the comparisons that should have been made when the new genera were proposed. My comments and generic diagnoses are based on materials in the National Museum or on specimens examined through loan or exchanges. It is sincerely hoped that this treatment is a step forward in working out the generic limits of this complex subfamily.

Since I do not have specimens available of all the species of silversides described and belonging to this subfamily, I shall leave the assignment of the various species to the proper genus until the types can be examined by those ichthyologists working in the museums where the material is preserved.



## Genus TAENIOMEMBRAS Ogilby

*Taeniomembras* OGILBY, Proc. Linn. Soc. New South Wales, vol. 23, p. 241, 1898 (genotype: *Atherina microstoma* Günther).

*Pranesella* WHITLEY, Victorian Nat., vol. 50, No. 10, p. 241, 1934 (genotype: *P. endorae* Whitley).

Jordan and Hubbs' reference (1919, p. 42) to specimens of *A. microstoma* from Victoria indicates that the rami of the mandibles are elevated and the mouth scarcely smaller than several other species of the genus. This appears to agree with two specimens from the South Australian Museum sent to me by the director, Herbert M. Hale, to whom I express my sincere thanks for his cooperation. The two specimens (now U. S. N. M. No. 123274) are from Port Willunga, Australia, and were identified as *Atherina microstoma* by E. R. Waite. The rami of the mandibles are somewhat elevated; the maxillary reaches to a vertical line at front of eye; there are a few minute teeth on the vomer but none on the palatines; and the air bladder ends abruptly and in front of the anal origin. From these two specimens the generic description was made.

I am referring *Pranesella endorae* Whitley to this genus on the basis of his 1934 description.

## Genus CRATEROCEPHALUS McCulloch

*Craterocephalus* MCCULLOCH, Proc. Roy. Soc. Queensland, vol. 24, p. 48, pl. 1, fig. 1, 1912 (genotype: *C. fluviatilis* McCulloch).

The diagnosis of this genus in the key is based on the original description of the new genus and new species by McCulloch, cited above, and on eight specimens of *Craterocephalus stercusmuscarum* kindly sent to me by Dr. Ian S. R. Munro. These were taken in the Barrow River, Kuranda, North Queensland.

Other species belonging to this genus are *C. nouhuysi* (Weber), *C. lacustris* Trewavas, *C. randi* Nichols and Raven, and *C. annator* Whitley.

## STENATHERINA, new genus

FIGURES 1a, 2b, 3b

*Genotype*.—*Atherina temminckii* Bleeker = *A. brachyptera* Bleeker.

This new genus differs from all other genera in the subfamily Taeniomembrasinae by having the ascending premaxillary process at front of snout long, slender, and extending past front of orbits into the interorbital space, with a second process or spinelike projection laterally on the premaxillary. Other important differences are diagnosed in my key. *Stenatherina* is characterized by its slender, fusiform body; the air bladder ending bluntly and abruptly a little in front of the anal-fin origin; the rami of mandible somewhat elevated; the gill



rakers long and slender; ascending premaxillary process long, slender, spinelike, reaching far into the interorbital space; lips fused at rear corner of mouth about one-fourth their lengths; anus far in advance of anal origin; maxillary reaching to under front of eye.

McCulloch and Waite (Rec. South Australian Mus., vol. 1, No. 1, p. 41, 1918) redescribed *Taeniomembras tamarensis* (Johnson, Proc. Roy. Soc. Tasmania, 1882 [1883], p. 122, and 1890 [1891], p. 34). These descriptions and 12 specimens taken at Schouten Island, and another lot of six from Oyster Bay, both Tasmania, were sent to me

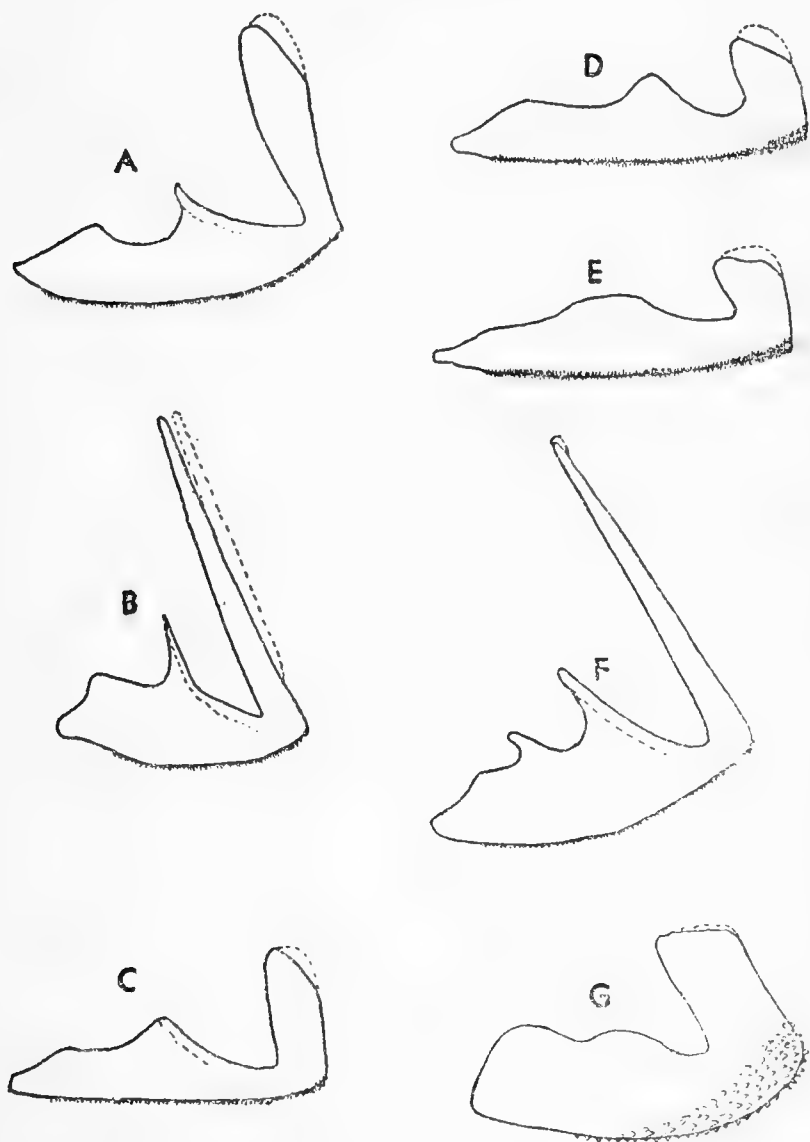


FIGURE 2.—Diagrammatic sketches of the premaxillaries of certain species of Atherinidae: *A*, *Hepsetia rissoi* (Cuvier and Valenciennes), based on U.S.N.M. Nos. 10088 and 121859 from Europe, Bonaparte collection; *B*, *Stenatherina temminckii* (Bleeker), based on U.S.N.M. No. 136763 from the Philippines; *C*, *Hepsetia boyeri* (Risso), based on U.S.N.M. Nos. 2942 and 48366 from Europe, Bonaparte collection; *D*, *Allanetta area* (Jordan and Gilbert), based on U.S.N.M. No. 89597 from Cuba; *E*, *Pranesus insularum* (Jordan and Evermann), based on U.S.N.M. No. 51169 from Hawaii; *F*, *Atherina hepsetus* Linnaeus, based on U.S.N.M. Nos. 10157, 45535, and 48365 from Europe; *G*, *Atherion elymus* Jordan and Starks, based on U.S.N.M. No. 49812, paratypes from Japan.

by Dr. Ian S. R. Munro. They have been useful in the diagnosis of this genus. Two vertebral counts were 21+26 and 21+26.

Dr. Munro sent me two other lots of atherinids that I have identified as *Stenatherina honoriae* (Ogilby). Seven specimens came from the lower reaches of the Noosa River, Queensland, and the other from the Barrow River, Kuranda, North Queensland. The vertebrae were 19+19 in one specimen, whereas Ogilby recorded 21+20.

Some of the species in the Australian region centering around *Taeniomembras*, *Craterocephalus*, and *Stenatherina* cannot be assigned to the correct genus until their types are examined. Undoubtedly new genera will be proposed, or possibly, as connecting and intermediate species are studied, some of these genera will be united.

Named *Stenatherina* in reference to an atherine fish with a narrow premaxillary process.

A reexamination of specimens collected by me in the Phoenix and Samoan Islands indicates that U. S. N. M. Nos. 115112 and 115113 are *Stenatherina temminckii* and not "*Atherina wisila*."<sup>3</sup>

#### Genus ALEPIDOMUS Hubbs

*Alepidomus* HUBBS, Occ. Pap. Mus. Zool. Univ. Michigan, No. 488, p. 7, 1944 (genotype: *Atherina evermanni* Eigenmann).

The generic diagnosis was based on six specimens of *A. evermanni* from Cuba bearing U. S. N. M. numbers 55697, 1 cotype; 126667, 4 cotypes; and 102203.

Apparently this genus is monotypic and so far has been found only in the fresh waters of the Island of Cuba.

Prof. Luis René Rivas, Colegio de la Salle, Habana, Cuba, has kindly summarized for me some of the localities where *A. evermanni* occurs on the Island of Cuba: Laguna de Piedras, a turbid body of fresh water, southeastern part of Pinar del Río Province, southwest of Artemisa, about 12 km. from the sea. Its outlet is a very small stream called Río Crespo and flows into the sea. The second locality is the Río Negro of the Hatiguanico System, Ciénaga de Zapata, in Province of Matanzas, a large stream emptying into La Broa Bay. The third locality is Arroyo Blanco de Mabuya, northwestern part of Camagüey Province, a small clear stream.

#### Genus ALLANETTA Whitley

FIGURES 2d, 3f

*Allanetta* WHITLEY, Proc. Linn. Soc. New South Wales, vol. 68, p. 135, 1943 (genotype: *Atherina mugiloides* McCulloch [Proc. Roy. Soc. Queensland, vol. 24, p. 47, fig. 1, from Cape York, 1912]=*Atherinichthys punctatus* de Vis 1885).

<sup>3</sup> See U. S. Nat. Mus. Bull. 180, p. 78, 1943.

I have examined the types of *Atherina araea* Jordan and Gilbert, U. S. N. M. No. 34967; *Atherina harringtonensis*, U. S. N. M. No. 21945; and paratypes of *Atherina ovalaua* Herre, U. S. N. M. Nos. 117318-9, 142910, 142911 sent in exchange by the Chicago Natural History Museum and refer them to this genus.

Among the species from the Pacific and Indian Oceans, I refer the following to this genus on the basis of material examined in the National collections: *Atherina valenciennesii* Bleeker; *A. duodecimalis* Cuvier and Valenciennes; *A. bleekeri* Günther; *A. woodwardi* Jordan and Starks; *A. balabacensis* Seale; and *A. regina* Seale.

### HYPOATHERINA, new genus

FIGURE 3c

*Genotype*.—*Atherina visila* Jordan and Seale.

This new genus is related to *Allanetta* but differs in having the anus behind the tips of the pelvics and usually under the base of the first dorsal fin. The gill rakers are long and slender, the mouth large, rear of maxillary reaching a vertical line through the front of the orbit; vertebral counts in three specimens indicate about 18 or 19+22 or 23 vertebrae. The ascending premaxillary processes are moderately long and broad based but do not reach to opposite front of orbits; rami of mandibles elevated; origin of first dorsal near middle of standard length. This new genus may be separated from all related genera by the characters given in my key.

*Hypoatherina* is closely related to *Stenatherina* and shares with it the possession of an elongate median preanal membranous bony plate, embedded in flesh in front of the pterygiophores.

To the new genus *Hypoatherina* I refer U. S. N. M. No. 49816, three paratypes of *Atherina tsurugae* Jordan and Starks; U. S. N. M. No. 51726 and No. 126300, numerous cotypes of *A. visila* Jordan and Seale; *A. panatela* Jordan and Richardson; *A. gobio* Klunzinger; *A. lacunosa* Forster in Bloch and Schneider as restricted and defined by Ogilby (Mem. Queensland Mus., vol. 1, p. 40, pl. 12, fig. 2, 1912) and based on U. S. N. M. No. 132607 from Queensland.

### Genus PRANESUS Whitley

FIGURES 2e, 3e

*Pranesus* WHITLEY, Mem. Queensland Mus., vol. 10, pt. 1, p. 9, 1930 (genotype: *P. ogilbyi* Whitley, based on Ogilby's figure of *Atherina pinguis* (not of Lacepède) from Moreton Bay, Queensland, in Mem. Queensland Mus., vol. 1, p. 38, pl. 12, fig. 1, 1912).

*Thoracatherina* FOWLER, Proc. Acad. Nat. Sci. Philadelphia, vol. 93, p. 249, 1941 (genotype: *Atherina insularum* Jordan and Evermann).

Studies of paratypes of *A. insularum*, U. S. N. M. No. 126902, from Hawaiian Islands, and Zanzibar specimens of *A. pinguis* Lacepède

indicate that these species belong in this genus. I have examined several lots from the Hawaiian and Philippine Islands and one lot from off Mauritius.

*Atherina morrissi* Jordan and Starks, *A. lineatus* Günther, *A. endrachtensis* Quoy and Gaimard, and *A. vaigiensis* Quoy and Gaimard belong in this genus. There may be several others that should be referred here.

#### Genus *ATHERINOMORUS* Fowler

##### FIGURE 3d

*Atherinomorus* FOWLER, Proc. Acad. Nat. Sci. Philadelphia, vol. 55, p. 730, 1903 (genotype: *Atherina laticeps* Poey=*Atherina stipes* Müller and Troschel).

The generic diagnosis was based on numerous specimens of *A. stipes* from the western North Atlantic, the collection containing so many lots that it is not practical to list the U. S. N. M. numbers here except for the types of *Atherina laticeps* Poey from Cuba, U. S. N. M. No. 4764, and *Atherina velieana* Goode and Bean, U. S. N. M. No. 23629.

#### *ATHERIONINAE*, new subfamily

##### Genus *ATHERION* Jordan and Starks

##### FIGURE 2g

*Atherion* JORDAN and STARKS, Proc. U. S. Nat. Mus., vol. 24, p. 203, 1901 (genotype: *Atherion elymus* Jordan and Starks, from Japan).

This aberrant genus of silversides is placed in a separate subfamily because *Atherion* appears to be intermediate between the *Taeniomembrasinae* and the *Menidiinae*.

*Atherion* combines the concave premaxillary, shagreenlike denticles on outer surface of premaxillary, broad-based and short ascending premaxillary process, and broadened end of premaxillary, with the body cavity ending bluntly in front of the anal origin and not entering the haemal arches.

The five paratypes of *A. elymus*, U. S. N. M. No. 49812, from Japan, were examined, as well as numerous other specimens of the same genus from Guam and Bikini Atoll. The paratypes are in a bad state of preservation, having been dried. Two other species are *A. maccullochi* Jordan and Hubbs and *Atherina villosa* Duncker and Mohr, referable to this genus.

#### *TROPIDOSTETHINAE*, new subfamily

This subfamily contains, at the present time, three genera characterized by their greatly compressed bodies, with the head short and truncate posteriorly; the air bladder not extending into the haemal arches as in the *Atherininae*; the greatest depth of the body occurring near the rear of the head and then the body tapering to the least depth

at the caudal peduncle and compressed throughout, with the ventral edge of the belly of almost paper thinness; premaxillaries, although nonprotractile, not dilated posteriorly, thus suggesting relationships with the Taeniomembrasinae.

### Genus NOTOCHEIRUS Clark

*Notocheirus* CLARK, Copeia, 1937, No. 2, p. 88 (genotype: *Notocheirus hubbsi* Clark).

This remarkable genus, based on two specimens from Valparaiso Harbor, Chile, is one of the most aberrant of the atherine fishes, related to *Tropidostethus rhotophilus* Ogilby from the Australian region and *Iso flos-maris* Jordan and Starks from Japan. I have examined the paratype of *N. hubbsi*, and the generic diagnosis is based largely on that specimen. Indeed I have gone to great trouble to make a count of the vertebrae, which number 14+26 on the paratype, kindly lent me for study by Dr. W. M. Chapman, curator of fishes, California Academy of Sciences.

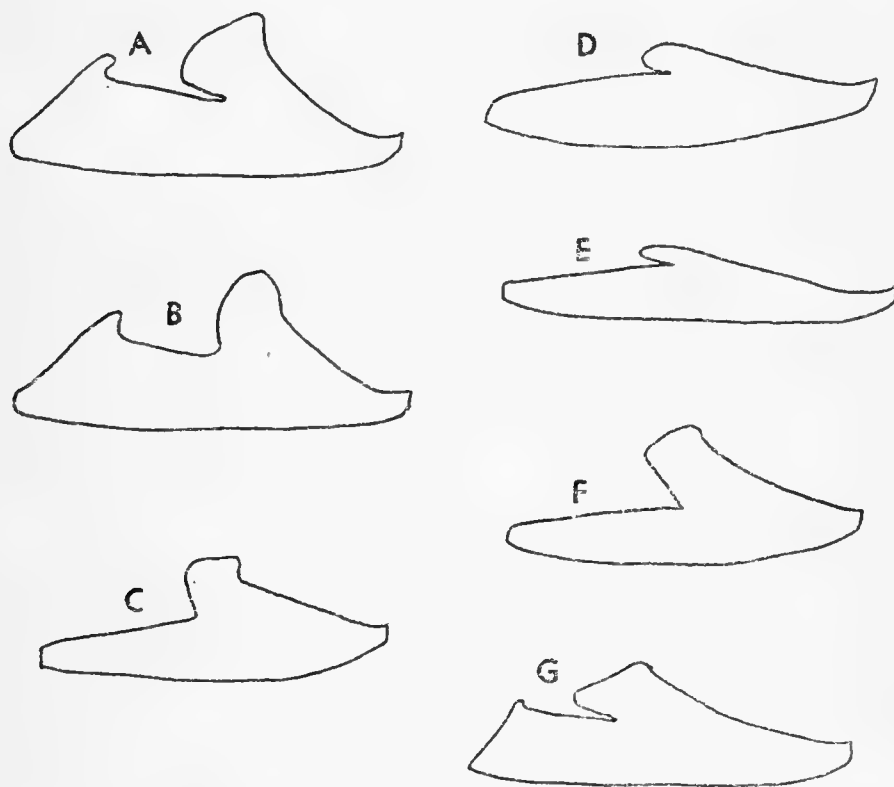


FIGURE 3.—Diagrammatic sketches of the mandibles of certain species of Atherinidae, dentition omitted: A, *Hepsetia rissoi* (Cuvier and Valenciennes), based on U.S.N.M. Nos. 10088 and 121859 from Europe, Bonaparte collection; B, *Stenatherina temminckii* (Bleeker), based on U.S.N.M. No. 136694 from the Philippines; C, *Hypoatherina uisila* (Jordan and Seale), based on U.S.N.M. Nos. 126300, paratypes from the Samoan Islands; D, *Atherinomorus stipes* (Müller and Troschel), based on U.S.N.M. No. 37098 from Cozumel Island; E, *Pranesus pinguis* (Lacepède) based on U.S.N.M. No. 136812 from the Philippines; F, *Allanetta area* (Jordan and Gilbert), based on U.S.N.M. No. 89597 from Cuba; G, *Hepsetia boyeri* (Risso), based on U.S.N.M. No. 48366 from Italy, Bonaparte collection.

## Genus TROPIDOSTETHUS Ogilby

*Tropidostethus* OGILBY, Proc. Linn. Soc. New South Wales, vol. 10, p. 332, 1895 (genotype: *Tropidostethus rhotophilus* Ogilby, from Maroubra Bay, Australia).

The generic diagnosis is based on three cotypes, U. S. N. M. No. 48830, from Maroubra Bay and on another lot of the genotype sent to the National Museum by Dr. Ogilby in 1894 and now bearing the number 45554. These latter specimens are in an excellent state of preservation and bore an unpublished manuscript name by Ogilby, which I have removed from the jar. It is highly probable that this is part of the collection used by Ogilby in describing *Tropidostethus rhotophilus*. One of the specimens had 14+28 vertebrae.

Dr. A. W. C. T. Herre (Proc. Biol. Soc. Washington, vol. 57, pp. 46-47, 1944) recently described as new *Iso flos-indicus* from India. On exchange Dr. Herre kindly sent four paratypes to the National Museum (No. 123651), one of which has 15+25 vertebrae. A study of these indicates that they belong to *Tropidostethus*, along with *rhotophilus* Ogilby and *natalensis* Regan. Dr. J. L. B. Smith (Rec. Albany Mus. South Africa, vol. 4, pt. 2, pp. 178-180, pl. 19, fig. c, 1935) gives a beautiful figure and good description of *natalensis* Regan, and without hesitation I refer it to this genus.

## Genus ISO Jordan and Starks

*Iso* JORDAN and STARKS, Proc. U. S. Nat. Mus., vol. 24, p. 204, fig. 4, 1901 (genotype. *Iso flos-maris* Jordan and Starks, from Japan).

The generic diagnosis is based on three paratypes of *I. flos-maris*, U. S. N. M. No. 49817. Since specimens of the three genera recognized under this subfamily are so scarce, I have made but a single vertebral count on the genotype of each genus. The three paratypes of *I. flos-maris* were in a poor state of preservation, having been partially dried at some time in the past. One of these has 18+26 vertebrae.

## MENIDIINAE, new subfamily

Now that the Atherinopsinae have been restricted to include those silversides with concave gape of mouth and with the air bladder tapering to a point posteriorly, and entering several modified haemal arches or terminating opposite modified vertebral hypophyses, there remains a group of genera more or less centering around *Menidia*. As here defined the new subfamily Menidiinae contains those silversides with concave gape of mouth; air bladder or body cavity ending abruptly, not extending into the haemal arches; and caudal vertebrae without modified haemal arches or broadened haemal hypophyses. The body cavity in certain genera does not quite reach to opposite the anal

origin, whereas in other genera it reaches a little past the anal origin.

Myers and Wade (Allan Hancock Pacific Exped., vol. 9, No. 5, p. 140, 1942) erected a new monotypic subfamily, *Melanorhininae*, for the Central American genus *Melanorhinus*, but the genus is an aberrant and highly specialized one, probably adapted for living in the surf.

In certain respects, such as the truncated head, air bladder ending bluntly, compressed body, and pectorals placed high on the body, *Melanorhinus* resembles the *Tropidostethinae* but differs from that subfamily in not having the premaxillaries expanded posteriorly, mid-ventral line of abdomen without a thin paperlike fleshy keel, head without denticles, among other characters. The absence of a silvery lateral band in *Melanorhinus* probably is not of much value in guessing relationships. Since the air bladder ends bluntly and the hypophyses are unmodified on the anterior caudal vertebrae of *Melanorhinus*, this genus is referred to the subfamily *Menidiinae*, which likewise have unmodified vertebrae.

#### Genus MELANORHINUS Metzelaar

*Melanorhinus* METZELAAR, Report on the fishes collected by Dr. J. Boeke in the Dutch West Indies 1904-05 . . ., p. 38, fig. 14, 1919 (genotype: *Melanorhinus boekei* Metzelaar).

*Mugilops* MEEK and HILDEBRAND, The marine fishes of Panama, pt. 1, p. 271, pl. 22, fig. 1, 1923 (genotype: *Mugilops cyanellus* Meek and Hildebrand).

Myers and Wade (Allan Hancock Pacific Exped., vol. 9, No. 5, pp. 139-141, 1942) were the first to point out that *Mugilops* is a synonym of *Melanorhinus*. *Mugilops marinus* Meek and Hildebrand of the Atlantic is undoubtedly a synonym of *M. boekei* Metzelaar, as indicated by Myers and Wade. The Pacific representative of this genus is *M. cyanellus* Meek and Hildebrand.

The generic diagnosis was based on the holotypes of both *Mugilops cyanellus*, U. S. N. M. No. 81748, and on *Mugilops marinus*, U. S. N. M. No. 81742; on two paratypes of *M. cyanellus*, U. S. N. M. Nos 79720 and 79721; four specimens from Panama Bay, U. S. N. M. No. 128570, and on U. S. N. M. No. 9432.

Carl L. Hubbs and Luis R. Rivas have redescribed *Melanorhinus microps* (Poey) in a paper entitled "Systematics of an American Atherine Fish, *Melanorhinus microps* (Poey)," Journ. Washington Acad. Sci., vol. 36, No. 11, pp. 393-396, 1946. This publication was based on U. S. N. M. No. 9432, 28 specimens from Cuba.

#### Genus ARCHOMENIDIA Jordan and Hubbs

*Archomenidia* JORDAN and HUBBS, A monographic review of the family of Atherinidae or silversides, p. 54, 1919 (genotype: *Atherinichthys sallei* Regan).

The generic diagnosis given in the key was based on three specimens

of *A. sallei* reported upon by Jordan and Hubbs, from Río Hueyopam, San Juan, Acayucan, Mexico. These three specimens, now comprising U. S. N. M. No. 123208, were kindly sent to me from the original lot by Dr. R. M. Bailey, University of Michigan.

#### Genus XENATHERINA Regan

*Xenatherina* REGAN, *Biologia Centrali-Americana, Pisces*, p. 64, 1907 (genotype: *Menidia lisa* Meek).

The generic diagnosis given in the key is based on 10 paratypes, U. S. N. M. Nos. 55851 and 82178, of *Menidia lisa* Meek from Refugio, Veracruz, Mexico.

#### Genus LABIDESTHES Cope

##### FIGURE 4b

*Labidesthes* COPE, *Proc. Amer. Philos. Soc.*, vol. 11, p. 455, 1870 (genotype: *Chirostoma sicculum* Cope).

The generic diagnosis is based on very numerous specimens of *L. sicculus* Cope, in so many lots from Eastern North America that it is not practical to list the U. S. N. M. numbers here. In addition, the type and paratypes of *L. vanhyningi* were examined, U. S. N. M. Nos. 88485 and 88486, respectively.

#### Genus ATHERINELLA Steindachner

*Atherinella* STEINDACHNER, *Sitz. Akad. Wiss. Wien*, vol. 71, p. 477 (p. 35 in reprint, *Ichth. Beiträge* No. 2), 1875 (genotype: *Atherinella panamensis* Steindachner).

The generic diagnosis given in the key was taken from Steindachner's description supplemented by that of Gilbert and Starks (*Mem. California Acad. Sci.*, vol. 4, p. 59, pl. 9, fig. 17, 1904). Only the genotype is known. I have not seen a specimen of *A. panamensis*.

#### Genus THYRINOPS Hubbs

*Thyrinops* HUBBS, *Proc. Acad. Nat. Sci. Philadelphia*, vol. 69, p. 306, 1918 (genotype: *Atherinichthys pachylepis* Günther).

*Thyrina* JORDAN and CULVER, in Jordan, *Proc. California Acad. Sci.*, ser. 2, vol. 5, p. 419, 1895 (genotype: *Thyrina evermanni* Jordan and Culver) (preoccupied).

The generic diagnosis given in the key was based on numerous lots of *T. pachylepis* Günther, from the Pacific side of Central America. These lots are too numerous to list the National Museum catalog numbers. In addition, I have examined the holotype and paratypes of the following species and refer them to this genus:

*Thyrina guija* Hildebrand, holotype, U. S. N. M. No. 87273, and paratypes, U. S. N. M. Nos. 87274-87277.

*Menidia chagresi* Meek and Hildebrand, types, U. S. N. M. Nos. 79726 and 79728, and lectotype, U. S. N. M. No. 81761.



*Thyrina meeki* Miller, paratypes, U. S. N. M. Nos. 73935, 73954–73956, 73965.

*Kirtlandia beani* Meek and Hildebrand, holotype, U. S. N. M. No. 79741, and paratypes, U. S. N. M. No. 79740.

*Thyrina evermanni* Jordan and Culver, a paratype, U. S. N. M. No. 47494.

*Thyrina crystallina* Jordan and Culver, 3 paratypes, U. S. N. M. No. 47440.

*Melaniris sardina* Meek, 15 paratypes, U. S. N. M. No. 133087, were sent on exchange by the Chicago Natural History Museum.

Seven specimens of *Thyrinops colombiensis* (Hubbs), U. S. N. M. Nos. 79240, 120135, and 120223, from Colombia, Pacific side, are referred to this genus.

I have examined a large series of specimens of *Atherinichthys guatemalensis* Günther from near the type locality in Guatemala collected by Dr. R. R. Miller, and that species belongs in this genus. One specimen had 18+19 vertebrae.

I have before me the specimen, U. S. N. M. No. 116395, from Old Harbor, Jamaica, taken along with *Agonostomus monticola*, and possibly from fresh water that is closely related to *chagresi* but is less slender. I hesitate to describe it as a new subspecies since the specimen is not in a good state of preservation and relationships are too close for description and naming without a larger series.

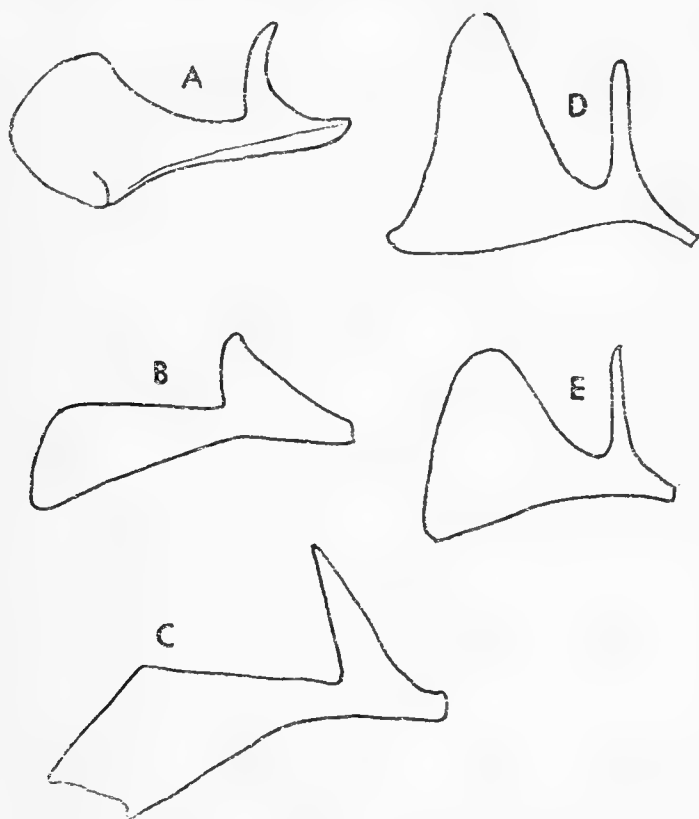


FIGURE 4.—Diagrammatic sketches of the premaxillaries of certain species of Atherinidae, dentition omitted: A, *Austromenidia regia* (Humboldt), based on U.S.N.M. No. 77293 from Lota, Chile; B, *Labidesthes sicculus* (Cope), based on U.S.N.M. No. 108574 from Alabama; C, *Xenomelaniris brasiliensis* (Quoy and Gaimard), based on U.S.N.M. No. 100901 from Brazil; D, *Leuresthes tenuis* (Ayers), based on U.S.N.M. No. 59473 from California; E, *Adenops analis*, new species, based on U.S.N.M. No. 121823, paratypes from Venezuela.

The following vertebral counts were made: *T. guija*, one count of 20+21; *T. pachylepis*, one count 20+21; *T. chagresi*, two counts 19+20 and 19+21; *T. meeki*, one count 20+20; *T. crystallina*, one count 18+21; *T. colombiensis*, one count 20+19.

#### Genus MELANIRIS Meek

*Melaniris* MEEK, Publ. Field Columbian Mus., zool. ser., vol. 3, No. 6, p. 117, 1902 (genotype: *Melaniris balsanus* Meek).

The diagnosis of this genus was based on 10 paratypes of *Melaniris balsanus*, U. S. N. M. No. 55793, from Río Balsas, Balsas, Mexico. I remove this species from *Thyrina* as recognized by Jordan and Hubbs in their 1919 review on the basis of the lower jaws being equal to or a little longer than upper, instead of shorter as in *Thyrinops*, and on the few number of abdominal vertebrae—15 or 16 instead of 18 to 20. The ascending premaxillary process of *Melaniris* is broad-based and triangular in shape whereas in *Thyrinops* it is narrower based, longer, and slenderer, and I find no glandlike structures on top of snout as in *Thyrinops*. The abdominal cavity extends to opposite the base of the second branched anal ray of *Melaniris* and notably farther posteriorly in *Thyrinops*.

#### Genus CHIROSTOMA Swainson

*Chirostoma* SWAINSON, The natural history and classification of fishes, amphibians and reptiles, or monocardian animals, vol. 2, p. 243, fig. 67, 1839 (genotype: *Atherina humboldtiana* Cuvier and Valenciennes).

*Atherinoides* BLEEKER, Verh. Batav. Gen. (Japan), vol. 25, p. 40, 1853 (genotype: *Atherina humboldtiana* Cuvier and Valenciennes).

*Atheronichthys* BLEEKER, *ibid.*, p. 41, 1853 (genotype: *Atherina vomerina* Cuvier and Valenciennes=*C. humboldtiana*).

*Heterognathus* GIRARD, Proc. Acad. Nat. Sci. Philadelphia, vol. 7, p. 198, 1854 (genotype: *Atherina humboldtiana* Cuvier and Valenciennes).

*Lethostole* JORDAN and EVERMANN, U. S. Nat. Mus. Bull. 47, pt. 1, p. 792, 1896 (genotype: *Chirostoma estor* Jordan).

*Elopsarum* JORDAN and EVERMANN, Rept. U. S. Fish Comm. for 1895, p. 330, 1896 (genotype: *Chirostoma jordani* Woolman).

*Atherinichthys* BLEEKER, in Jordan, Genera of fishes, pt. 2, p. 253, 1919 (emended spelling).

*Charalia* DE BUEN, Ann. Inst. Biol. Mex., vol. 16, No. 2, p. 505, 1945 (genotype: *Chirostoma bartoni* Jordan and Evermann).

*Palmichthys* DE BUEN, *ibid.*, p. 527 (genotype: *Chirostoma diazi* Jordan and Snyder).

*Acotlanichthys* DE BUEN, *ibid.*, p. 526 (genotype: *Chirostoma sphyraena* Boulenger).

*Otalia* DE BUEN, *ibid.*, p. 528 (genotype: *Chirostoma promelas* Jordan and Snyder).

Jordan and Hubbs (1919) and Jordan (*l. c.*, 1919) have interchanged the genotypes for Bleeker's genera *Atherinoides* and *Atheronichthys*, but I have corrected this in the synonymy above.

The genus *Chirostoma* appears to be related to *Menidia*, and such species as *Chirostoma jordani* are difficult to separate from *Menidia*, generically.

The generic diagnosis in the key is based on a large number of specimens of *Chirostoma humboldtiana* and numerous other species referable to *Chirostoma* from Mexico.

The following types and paratypes of the species listed below have been examined:

*Chirostoma attenuatum* MEEK, paratypes, U. S. N. M. No. 55782.

*Chirostoma promelas* JORDAN and SNYDER, paratype, U. S. N. M. No. 61274.

*Chirostoma zirahuen* MEEK, paratype, U. S. N. M. No. 55780.

*Chirostoma jordani* WOOLMAN, type, U. S. N. M. No. 45572, paratypes, U. S. N. M. Nos. 37830, 47509, 125441.

*Chirostoma bartoni* JORDAN and EVERMANN, type, U. S. N. M. No. 23136.

*Chirostoma estor* JORDAN, type, U. S. N. M. No. 23124.

Dr. F. De Buen (Ann. Inst. Biol. Mex., vol. 16, No. 2, pp. 499–530, 1945) has recognized certain genera and subgenera in his recent studies of Mexican silversides. He has given full generic rank to *Elopsarum*, with the following subgenera: *Elopsarum* Jordan and Evermann, including *E. arge* Jordan and Snyder, *E. labarcae* (Meek), *E. jordani jordani* (Woolman), and *E. j. mezquital* (Meek); *Charalia* De Buen, including *E. regani* (Jordan and Hubbs), *E. bartoni charari* De Buen, *E. bartoni bartoni* (Jordan and Evermann), and *E. bartoni zirahuen* (Meek). Under the genus *Chirostoma* Swainson, De Buen (p. 510) recognizes the following subgenera: *Palmichthys* De Buen, including only the genotype, *Chirostoma diazi* Jordan and Snyder; *Ocotlanichthys* De Buen, including only *Chirostoma sphyraena* Boulenger, the genotype.

*Lethostole* Jordan and Evermann has the following species or subspecies referred to it by De Buen (1945, pp. 521–522): *Chirostoma estor estor* Jordan, *C. estor pacanda* De Buen, and *C. estor copandaro* De Buen.

*Chirostoma* Swainson has the following species referred to this subgenus by De Buen (1945, pp. 511–512): *Chirostoma humboldtianum* (Cuvier and Valenciennes), *C. chapalae* Jordan and Snyder, *C. compressum* De Buen, *C. grandocule* (Steindachner), *C. consocium* Jordan and Hubbs, *C. ocotlanae* Jordan and Snyder, and *C. lucius* Boulenger.

De Buen recognizes as a full genus *Otalia* De Buen, referring but one species, *Chirostoma promelas* Jordan and Snyder, the genotype, to it.

Since the morphological characters of these genera and subgenera overlap considerably, I am inclined to recognize but one genus, *Chirostoma*, and would prefer, at present, to consider those proposed by De Buen at most of no higher rank than subgenera. Since no full com-

parison was made between the various generic units proposed by De Buen, the relationships of these forms are not clear.

### Genus MENIDIA Bonaparte

*Menidia* BONAPARTE, Iconografia della fauna italica . . . , vol. 3, Pesci, named in description of *Atherina hepsetus*, fasc. 91, 1836 (no type listed, but *Atherina menidia* Linnaeus intended; also genotype fixed by tautonomy).

*Argyrea* DEKAY, Zoology of New York, or the New York fauna, pt. 3, p. 141, 1842 (genotype: *Atherina notata* Mitchell) (preoccupied).

*Ischnomembras* FOWLER, Proc. Acad. Nat. Sci. Philadelphia, vol. 55, p. 730, 1903 (genotype: *Ischnomembras gabunensis* Fowler) (said to be from Gabun River, Africa, but according to Jordan and Hubbs locality is in error).

*Phoxargyrea* FOWLER, *ibid.*, p. 732, 1903 (genotype: *Phoxargyrea dayi* Fowler) (said to be from India, but according to Jordan and Hubbs this is in error).

I have examined specimens of *Menidia menidia* (Linnaeus) from Charleston, S. C., the type locality of the genotype, as well as numerous specimens from the Atlantic coast in the National collections, the lots too numerous to make it practical to list the catalog numbers. Also I have examined numerous lots of *Menidia beryllina* and *M. peninsulæ*. The latter species appears to have fewer caudal vertebrae; in 10 counts I found a range of 17 to 19 + 19 to 22, whereas in *M. menidia* in 4 counts the range was 17 to 19 + 24 to 27 vertebrae. No doubt the number of caudal vertebrae in the species of *Menidia* would overlap if numerous additional counts were made throughout the range of these species.

I have examined the types and paratypes of the species listed below and refer them to this genus. *Menidia beryllina cerea* Kendall, type, U. S. N. M. No. 50011, and paratypes, U. S. N. M. No. 125548. *Menidia peninsulæ atrimentis* Kendall, type, U. S. N. M. No. 50010, and paratypes, U. S. N. M. Nos. 18070, 50459, 50467, 126783. *Menidia audens* Hay, types, U. S. N. M. Nos. 32206, 32303, 32307, 32308. *Chirostoma peninsulæ* Goode and Bean, types, U. S. N. M. No. 21481. *Menidia dentex* Goode and Bean, types, U. S. N. M. No. 18051. *Menidia extensa* Hubbs and Raney, paratypes, U. S. N. M. No. 106716.

Two other specimens of *Menidia extensa*, U. S. N. M. No. 123800 from Lake Waccamaw, N. C., were studied. One has 21 + 22 vertebrae, anal rays II, 18 and II, 19, scales 43, and scales before dorsal 19.

### Genus POBLANA de Buen

*Poblana* DE BUEN, Ann. Inst. Biol. Mex., vol. 16, No. 2, p. 495, 1945 (genotype: *Poblana alchichica* De Buen).

The characterization of this genus is based on two paratypes, U. S. N. M. No. 123671, kindly sent to me on exchange from the University of Michigan Museum by Dr. R. M. Bailey. One of these has 16 + 22 vertebrae.

*Poblana* appears to be closely related to *Menidia* on the basis of the extension of the body cavity backward to over first few rays of anal fin, and the elongate, spinelike ascending process on the premaxillary among other characters.

The absence of scales anteriorly on the head and body may not be of much importance in determining relationships since the condition occurs in four other phyletic lines in the family Atherinidae: *Xenatherina*, *Alepidomus*, *Tropidostethus*, and *Iso*. In the first the ascending premaxillary processes are broad-based triangular plates. The last three genera are in other subfamilies.

#### MENIDIELLA, new genus

*Genotype*.—*Menidia colei* HUBBS, Carnegie Inst. Washington Publ. No. 457, p. 248, pl. 10, fig. 1, 1936.

This new genus is related to *Menidia* but differs in being shorter and deeper bodied, with about 14+18 vertebrae instead of about 18 or 19+19 to 26 as in *Menidia*. In addition, the base of the anal fin is shorter, and there are fewer anal fin rays than in *Menidia*. *M. beryllina* approaches in shape of body that of *Menidiella*, closest of the species referred to the genus *Menidia*, but the air bladder or body cavity of *M. beryllina* extends notably past the anal-fin origin, whereas in *Menidiella colei* the body cavity reaches just to the anal-fin origin.

This new genus may be separated from all other related genera of Atherinidae by the characters given in my key.

For the generic description three paratypes of *Menidia colei* Hubbs, U. S. N. M. No. 117556, and the holotype of *Menidia conchorum* Hildebrand and Ginsburg, U. S. N. M. No. 87535, were used.

#### XENOMELANIRIS, new genus

FIGURES 4c, 5b

*Genotype*.—*Atherina brasiliensis* Quoy and Gaimard.

The generic diagnosis of this new genus given in my key was based on the following specimens of *X. brasiliensis* in the collections of the United States National Museum: From Brazil, Nos. 83149, 100874, 100901, and 104220, totaling 11 specimens; from Trinidad, No. 5794, one specimen; from Venezuela, Nos. 121821, 121822, and 123204, totaling 13 specimens.

In addition to the genotype, *Menidia venezuelae* Eigenmann belongs to this genus. I have examined five specimens, 25.5 to 33.5 mm., from Lago de Valencia collected by Dr. F. F. Bond and lent me for study and report by Dr. R. M. Bailey, University of Michigan.

## ADENOPS, new genus

FIGURES 4e, 5d

*Genotype*.—*Adenops analis*, new species.

This new genus has the premaxillary dilated posteriorly; premaxillary or gape of mouth a little concave at side; rictus restricted by a membrane folding between jaws; dentigerous surface of premaxillaries not reflected outward and covering face of that bone with "shagreen"; two dorsal fins present; silvery lateral band present; mouth small, the maxillary not reaching to eye; air bladder and body cavity not reaching anywhere near to opposite anal fin origin; first dorsal origin notably in front of anal origin; pelvic insertions equidistant or closer to opercular margins or upper angle of pectoral fin base than to anal origin; about five or six scales forming a sheath anteriorly along base of anal fin; margin of scales entire or crenulate; distal margins of dorsal and anal fins concave; ascending process of premaxillary a narrow-based elongate spinelike projection; vertebrae 14 to 16+22 to 26.

Other characters are those of the genotype. The genus differs from all other genera of the family except *Membras* and *Thyrinops* by having four shallow glandlike depressions on the dorsal surface of the snout. From *Membras* it differs in having the anus near the middle of the distance between anal origin and the pelvic bases, instead of a little in front of anal origin, and in having fewer abdominal vertebrae, 14 to 16 instead of 18 to 20. It may be separated from other Atherinidae by the characters given in the key. In *Thyrinops* the air bladder extends some distance past the anal-fin origin.

The only other American atherine fish with the posterior end of the premaxillary dilated that has the anus far forward is *Archomenidia sallei* (Regan), but in this genus the body cavity and air bladder extend conspicuously some distance past the anal-fin origin.

Named *Adenops* in reference to the four depressions on the dorsal surface of snout, which appear to be glandular.

## ADENOPS ANALIS, new species

FIGURE 6

*Holotype*.—U. S. N. M. No. 121824, a specimen 59 mm. in standard length, collected by Leonard P. Schultz at night by flashlight in Lago de Maracaibo, 1 km. off Pueblo Viejo, Venezuela, on April 7–8, 1942.

*Paratypes*.—U. S. N. M. No. 121823, 66 specimens, 9 to 53.5 mm. in standard length, taken along with the holotype and bearing same data. There appear to be at least two age groups in this lot, with 25 specimens 9 to 17.5 and 41 specimens 19.5 to 53.5 mm.

*Description.*—Detailed measurements were made on the holotype and two paratypes, and these data, expressed in hundredths of the standard length, are recorded in table 1.

Greatest depth of body about  $5\frac{1}{2}$  to  $5\frac{3}{4}$ , head  $4\frac{1}{2}$  to  $4\frac{2}{3}$ , both in standard length; snout  $3\frac{1}{2}$  to  $3\frac{3}{4}$ , orbit  $3\frac{1}{3}$  to  $3\frac{1}{2}$ , interorbital 3 to  $3\frac{1}{3}$ , all in length of head; premaxillary a little curved, causing gape of mouth to be somewhat concave; mouth rather small, the maxillary not reaching to front of orbit; gill rakers slender, the longest about two-thirds diameter of pupil; rear margin of pupil about in middle of length of head; pelvic fin insertions a little closer to upper angle of pectoral-fin base than to anal origin; anal origin equidistant between midbase of caudal fin and second third of length of opercle; first dorsal origin conspicuously a little in front of a line through anal origin; second dorsal origin about over base of sixth from last anal-fin rays; pelvic fins short, usually reaching a trifle over halfway to anal origin; the anus is located nearly equidistant between anal origin and pelvic bases, but much closer to pelvic bases in the smaller ones; the body cavity extends only a trifle past anal opening; the ascending premaxillary processes are long, slender, with narrow bases, not triangular in shape; pectoral fins pointed, reaching a short distance past pelvic bases; interorbital space a little convex; belly rounded; posterior margins of scales entire; silvery lateral band present, wider than pupil anteriorly, but constricted a little on caudal peduncle where it is not quite so wide as pupil; least depth of caudal peduncle  $2\frac{1}{5}$  to

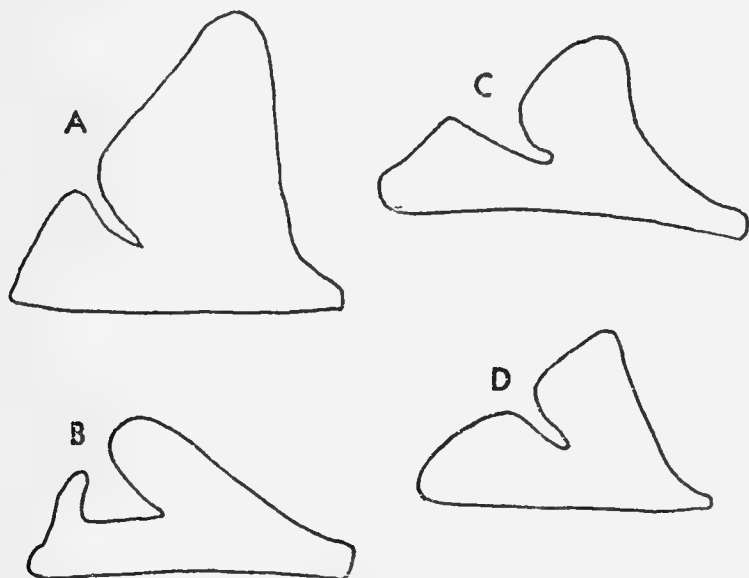


FIGURE 5.—Diagrammatic sketches of the mandibles of certain species of Atherinidae, dentition omitted: *A*, *Leuresthes tenuis* (Ayers), based on U.S.N.M. No. 54493 from California; *B*, *Xenomelaniris brasiliensis* (Quoy and Gaimard), based on U.S.N.M. No. 100901 from Brazil; *C*, *Austromenidia regia* (Humboldt), based on U.S.N.M. No. 77293 from Lota, Chile; *D*, *Adenops analis*, new species, based on U.S.N.M. No. 121823, paratypes from Venezuela.



2½ in its length; lower jaw a little shorter than upper, slightly included; teeth minute in both jaws in a narrow villiform band.

The following counts were made, respectively: Dorsal rays, IV-I, i, 8; V-I, i, 7; and IV-I, i, 7. Anal rays I, i, 14; I, i, 14; and I, i, 14. Pelvics always I, 5. Pectoral rays —; i, 12-i, 12; and i, 12. Branched caudal rays 15; 15; 15. Scales above lateral line to first dorsal origin 3½; 3½; 3½, and below lateral line to anal origin 2½; 2½; and 2½. Scales in the lateral line 44; 44; 44. Scales in front of first dorsal to rear of pigmented area over brain, 20; 21; 20. Scales between anal origin and anus 4; 4; 4. Scales between dorsal bases of dorsal fins 7; 7; 6. Zigzag scales around least depth of caudal peduncle 12; 12; and 12. Gill rakers on first gill arch 4 + 1 + 14; —; and 2 + 1 + 13. Additional counts will be found in table 1.

*Coloration*.—In alcohol, straw-colored with silvery lateral band, bordered above by a narrow dark streak, wider anteriorly; middorsal line with a prominent row of black pigment spots or cells; each scale of back above silvery lateral band with a black spot, some scales with two of these small pigment spots, thus making two rows of spots each side of middorsal line; tip of snout with black pigment; a few black pigment cells on sides of lower jaw and a few near its tip.

*Remarks*.—This new species differs from all other atherinids in having four glandlike depressions on the dorsal surface of the snout with the exception of species referred to *Thyrinops* and *Membras*. However, in the species of the latter genus the anus is only a short distance in front of the anal origin and the margins of the scales are usually strongly crenulate, whereas in the *Adenops analis* the anus is far forward and the margins of the scales are entire.

Named *analis* in reference to the position of the anus.

**ADENOPS ARGENTEUS, new species**

**FIGURE 7**

*Holotype*.—U. S. N. M. No. 121848, a specimen, 42.5 mm. in standard length, taken by the *Albatross* at Sabanilla, Colombia, March 16–22, 1884.

*Paratype*.—U. S. N. M. No. 121849, a specimen, 41.7 mm. in standard length, bearing same data as the holotype.

*Description*.—Detailed measurements were made on the holotype and paratype, and these data are recorded in table 1.

Greatest depth about 5, head 4½, both in standard length; snout 3½, orbit 3½, interorbital 2¾ to 3, all in length of head; premaxillary a little curved, the gape of mouth somewhat concave; mouth small. Maxillary not reaching anywhere near front of orbit; gill rakers slender, about two-thirds diameter of pupil; rear margin of pupil at middle of length of head; pelvic fin insertions equidistant between



anal origin and upper angle of pectoral-fin base; anal-fin origin equidistant between midbase of caudal fin and the second third of length of opercle; dorsal origin notably in front of anal origin, about at a point where a vertical line passes an equidistance between anal origin and anus; second dorsal origin about over base of sixth ray of anal fin; pelvic fin short, reaching just a trifle over halfway to anal origin; anus located just a trifle closer to anal origin than to pelvic bases just before tips of pelvic fins; body cavity extends only a little past anal opening but not to opposite anal-fin origin; the ascending premaxillary processes are long, slender, with narrow bases, not triangular in shape, and well separated at middorsal line; pectoral fins with tips broken off as are rays in most of the other fins; interorbital space a little convex, wide; belly rounded; posterior margins of scales crenulate; silvery lateral band present, wider than pupil anteriorly, but slightly constricted on caudal peduncle where it is about width of pupil; least depth of caudal peduncle about  $2\frac{1}{5}$  to  $2\frac{1}{2}$  in its length; lower jaw a little shorter than upper, slightly included; teeth minute in both jaws, in a narrow villiform band.

The following counts were made, respectively: Dorsal rays IV–I, i, 7 and IV–I, i, 7; anal rays I, i, 13 and I, i, 15; pectoral rays i, 10–i, 11 and i, 11–i, 11; pelvics always I, 5; branched caudal fin rays 15–15; scales above lateral line to first dorsal origin  $3\frac{1}{2}$  and  $3\frac{1}{2}$ , and below

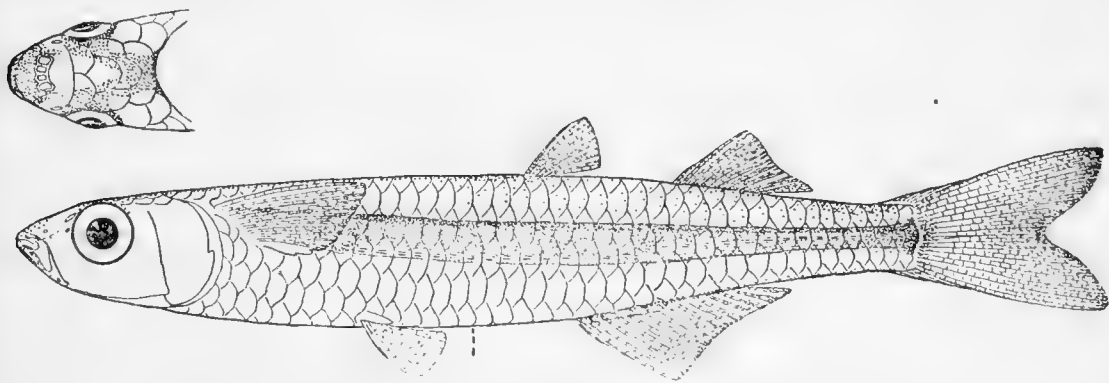


FIGURE 6.—*Adenops analis*, new species: Holotype, U.S.N.M. No. 121824. Standard length, 59 mm. Drawn by Mrs. Aime M. Awl.

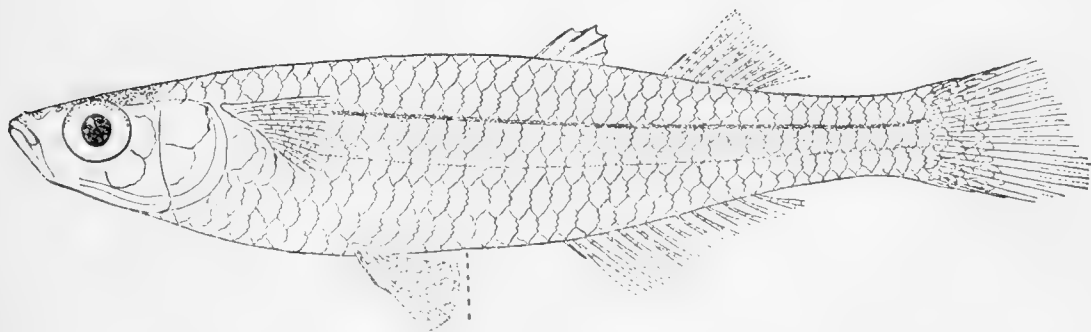


FIGURE 7.—*Adenops argenteus*, new species: Holotype, U.S.N.M. No. 121848. Standard length, 42.5 mm. Drawn by Mrs. Aime M. Awl.

lateral line to anal origin  $2\frac{1}{2}$  and  $2\frac{1}{2}$ ; scale rows from upper edge of gill opening to midbase of caudal fin 40 and 40; scales between anus and anal origin 4 or 5 and 5; scales in front of first dorsal 18 and 17; scale rows between dorsals 6 and 8; zig-zag scales around least depth of caudal peduncle 12 and —; gill rakers on first gill arch 2+1+15 and 2+1+15.

TABLE 1.—Measurements made on the two species of *Adenops*, expressed in hundredths of the standard length

Characters	<i>analis</i>			<i>argenteus</i>	
	Holo-type	Para-type	Para-type	Holo-type	Para-type
Standard length in millimeters.....	59	45.5	34.8	42.5	41.7
Length of head.....	22.0	21.5	22.4	22.8	22.1
Greatest depth of body.....	15.9	18.2	17.2	21.2	19.9
Length of snout.....	7.29	6.16	6.90	7.06	6.95
Diameter of orbit.....	6.61	6.16	7.46	7.30	7.20
Postorbital length of head.....	10.0	9.67	9.48	9.40	9.35
Width of bony interorbital space.....	7.46	7.25	8.33	8.47	8.15
Length of caudal peduncle.....	20.3	21.1	22.4	23.5	19.7
Least depth of caudal peduncle.....	7.96	8.79	9.48	8.20	8.77
Greatest width of head.....	10.9	10.6	9.48	11.5	10.5
Distance from:					
Pelvic insertion to anal origin.....	22.7	22.6	22.4	22.3	24.0
Snout tip to first dorsal origin.....	57.6	56.9	56.6	57.0	55.6
Snout tip to second dorsal origin.....	73.6	72.0	73.0	73.0	73.1
Snout tip to anal origin.....	62.7	59.1	61.7	60.4	60.9
Snout tip to pectoral insertion.....	22.5	21.8	23.3	23.5	22.1
Snout tip to pelvic insertion.....	40.3	37.6	40.8	40.0	37.7
First dorsal origin to second dorsal origin.....	16.3	16.0	17.2	17.7	18.7
Anal origin to center of anus.....	9.66	10.5	10.6	8.70	-----
Length of longest ray of:					
First dorsal fin.....	8.64	6.59	7.18	6.59	-----
Second dorsal fin.....	9.15	10.3	10.3	-----	-----
Anal fin.....	12.2	11.6	12.4	-----	-----
Pectoral fin.....	-----	16.0	16.4	-----	-----
Pelvic fin.....	10.9	10.5	10.3	11.8	12.0
Length of next to last ray of second dorsal.....	4.58	4.62	4.31	-----	-----
Length of last dorsal ray.....	6.95	6.59	5.17	7.06	7.67
Length of depressed second dorsal fin.....	15.4	15.4	15.8	16.2	16.8
Length of depressed anal fin.....	25.1	24.4	24.1	25.4	25.0
Length of base of second dorsal fin.....	9.49	9.23	8.62	9.40	9.59
Length of base of anal fin.....	18.8	20.0	18.7	18.6	20.4

*Color in alcohol.*—In addition to the silvery lateral band, bordered by dark brown above, the dark pigment appears to have faded except along middorsal line and on upper surface of head where it occurs over the brain and around the four glandular areas on upper surface of snout.

*Remarks.*—This new species may be distinguished from the other member of the genus and from *Membras* by means of the following key:

1a. Vertebrae usually 14 to 16+24 to 26; anus in middle third of length between anal origin and pelvic bases or closer to pelvic bases than anal origin; anus at tips of pelvic fins or in front of them; origin of first dorsal notably in advance of a vertical line through anal origin; pelvic insertions about equidistant between anal origin and upper angle of pectoral fin base.

2a. Scales with margins entire; anus about equidistant between anal origin and pelvic bases or trifle closer to the latter; anal rays I, i, 12 to 14; scales 42 to 45 (Lago de Maracaibo, Venezuela).

Adenops analis, new species

2b. Scale margins strongly crenulate; anus a little closer to anal origin than pelvic bases; anal rays I, i, 13 and I, i, 15; scales 40 and 41 (Sabanilla, Colombia) ----- Adenops argenteus, new species

1b. Vertebrae usually 18 to 20+23 to 25; anus in front of anal origin, a distance about one-fourth the way to pelvic bases, notably behind tips of pelvic rays; origin of first dorsal approximately over anal-fin origin or a trifle in advance of it; scales crenulate or at least with some of them with rough margins; pelvic insertions closer to anal origin than upper angle of pectoral fin base; scales 42 to 50 ----- Membras<sup>4</sup> Bonaparte

### Genus MEMBRAS Bonaparte

*Membras* BONAPARTE, Iconografia della fauna italiana . . . , vol. 3, Pesci, fasc. 91, 1836 (no type species mentioned but reference is made indirectly to Cuvier and Valenciennes, Histoire naturelle des poissons, vol. 10, pp. 458, 459, 1835); Jordan and Hubbs, A monographic review of the family of Atherinidae or silversides, p. 56, 1919 (genotype: designated *Atherina martinica* Cuvier and Valenciennes).

*Kirtlandia* JORDAN and EVERMANN, U. S. Nat. Mus. Bull. 47, pt. 1, p. 794, 1896 (genotype: *Chirostoma vagrans* Goode and Bean).

I concur in the opinion of Jordan and Hubbs that the generic name *Membras* Bonaparte is valid because there was a definite indication on the part of Bonaparte that he was taking the germ of his classification from that of Cuvier and Valenciennes. Since Cuvier and Valenciennes list a species (*Atherina martinica*) for one of the groups distinguished by them and since later a generic name (see p. 16) was assigned by Bonaparte, there remains no doubt about the validity of the genus *Membras* Bonaparte.

The nature of the species described by Cuvier and Valenciennes as *Atherina martinica* has never been exactly clear, even though Jordan once redescribed it. In an attempt to clear this matter up I wrote to Dr. L. Bertin, of the Muséum National d'Histoire Naturelle of Paris, and he examined the three types, furnishing the following information, for which I convey my sincere thanks to him:

The three types of *Atherina martinica* measure 68 (58), 99 (85), and 100 (86) mm. in length, with standard length given in parentheses. The body cavity does not extend quite to the anal-fin origin; ascending

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<sup>4</sup> The subspecies of this genus have not been clearly worked out, although *Membras martinica lacinata* is indicated by Jordan and Hubbs as ranging from New York to Florida and *Membras martinica vagrans* along the Gulf coast. If the form in the West Indies region is subspecifically distinct it should have the name *Membras martinica martinica*.

process of the premaxillary triangular; no sheath of scales along base of dorsal or of anal fins seen on the types, but these are easily lost in preservation, and since the majority of "*M. vagrans*" in the collections are lacking the scales, this character is of value only on perfectly preserved specimens; posterior margins of scales scalloped or entire; teeth in many rows on the premaxillaries and on the lower jaw; lower jaw largely included in upper when mouth is closed; first dorsal origin over anal origin; the former equal distance between caudal-fin base and rear of head; there are four glandular depressions, very clear, on the upper side of snout; dorsal rays 8, anal 19, pectoral 14, scales 45 and vertebrae  $19 + 23 = 42$ .

The number of vertebrae in *M. martinica*  $19 + 23$ , and the four glandular depressions indicate clearly that the types of *martinica* are the same species as has been currently passing under the names *Kirtlandia vagrans* or *Membras vagrans*. The only other known genus with which *Membras* could be confused is *Adenops*, but the number of vertebrae is 14 to  $16 + 24$  to 26 and the anus is farther forward in *Adenops*.

The generic diagnosis of *Membras* was based on the information furnished by Dr. Bertin; on the lectotype, U. S. N. M. No. 22848, and cotypes, U. S. N. M. No. 22864, of *Chirostoma vagrans* Goode and Bean (genotype of *Kirtlandia*); and on numerous other lots from the Atlantic and Gulf coasts of the United States, under so many catalog numbers that it is not practical to list them here.

I have not been able to locate the types of *Menidia vagrans lacinata* Swain but presume that *lacinata* is a synonym of *vagrans*, since I find in this genus only a single species, which forms subspecies<sup>4</sup> that intergrade throughout its range. The latter taxonomic units here have not been entirely clarified as yet.

#### Genus EURYSTOLE Jordan

*Eurystole* JORDAN, Proc. California Acad. Sci., ser. 2, vol. 5, p. 418, 1895 (genotype: *Atherinella eriarcha* Jordan and Gilbert).—JORDAN and EVERMANN, U. S. Nat. Mus. Bull. 47, pt. 1, p. 802, 1896 (genotype: *Atherinella eriarcha* Jordan and Gilbert).

The generic description given in the key is based on the holotype of *Atherinella eriarcha* Jordan and Gilbert, U. S. N. M. No. 29243, from Mazatlán, and on five other specimens, U. S. N. M. Nos. 101634, 101635, and 119021. Myers and Wade (Allan Hancock Pac. Exped., vol. 9, No. 5, pp. 115–126, 1942) in their revision of *Eurystole* refer only one species, the genotype, to this genus.

#### Genus NECTARGES Myers and Wade

*Nectarges* MYERS and WADE, Allan Hancock Pac. Exped., vol. 9, No. 5, p. 126, pl. 19, 1942 (genotype: *Nectarges nepenthe* Myers and Wade).  
*Euryarges* MYERS and WADE, Allan Hancock Pac. Exped., vol. 9, No. 5, p. 128, pl. 18, 1942 (genotype: *Nectarges nesiotes* Myers and Wade).

The generic description is based on that of Myers and Wade and on the following specimens in the National Museum: A paratype of *Nectarges nepenthe*, U. S. N. M. No. 119020; the type of *N. nocturnus* Myers and Wade, U. S. N. M. No. 88712; one paratype of *nocturnus*, U. S. N. M. No. 88713, and 17 other specimens, U. S. N. M. Nos. 31011, 107147, 127866–7; also a specimen of *N. nesiotes* Myers and Wade, U. S. N. M. No. 101633.

Myers and Wade in their revision of the genus *Nectarges* (*l. c.*) list three species as follows: *N. nesiotes* from the Galápagos Islands; *N. nepenthe* from Baja California to Oaxaca; and *N. nocturnus* from Ecuador and Peru.

#### Genus COLEOTROPIS Myers and Wade

*Coleotropis* MYERS and WADE, Allan Hancock Pac. Exped., vol. 9, No. 5, p. 136, 1942 (genotype: *Menidia starksi* Meek and Hildebrand).

The generic diagnosis is based on the holotype *Menidia starksi* Meek and Hildebrand, U. S. N. M. No. 79732, and on four paratypes, U. S. N. M. Nos. 79733 and 81747, from Taboga Island, Panama Bay.

#### Genus HUBBESIA Jordan

*Hubbesia* JORDAN, Proc. U. S. Nat. Mus., vol. 55, p. 310, 1919 (genotype: *Menidia gilberti* Jordan and Bollman).

The generic description in the key was based on 10 types, U. S. N. M. No. 41165, and 8 paratypes, U. S. N. M. Nos. 41210 and 41480, all of *Menidia gilberti* Jordan and Bollman. In addition I have examined so many other lots in the national collections that it is not practical to list the catalog numbers here. They all were from the Pacific side of Panama in the Panama Bay region.

Also I have four specimens from the mouth of the Río Mulegé, Baja California, that appear to be *Hubbesia gilberti*.

#### Subfamily ATHERINOPSINAE

This subfamily was set up by Fowler in 1904 and included *Atherinopsis*, *Protistius*, and *Gastropterus*, the last two names now being referred to the synonymy of *Basilichthys*. Jordan and Hubbs in their 1919 revision, not having investigated the nature of the air bladder in *Atherinopsis*, the type of the subfamily, included in their use of this name "all of the American species of the family, excepting a few of *Atherina* and *Hepsetia*." They go on to postulate about the ancestral type of this group, indicating that from "some *Menidia*-like form several distinct lines of evolution may be traced to aberrant genera." One must cast serious doubt on postulations on lines of evolution and closeness of relationship of genera when based largely, if not wholly, on external anatomy.

I am restricting the subfamily Atherinopsinae to that group of genera now known only from the Americas that have the premaxillary dilated or broadened posteriorly, its anterior edge concave, in combination with the air bladder tapering to a point posteriorly and extending opposite or into five or more of the broadened hypophyses of the haemal arches, these specialized hypophyses mostly interconnecting with one another by flattish, broadened, spinelike, bony processes opposite the tapering part of the air bladder. In certain genera such as *Atherinops*, *Atherinopsis*, and *Leuresthes* the haemal arches are small and the first one occurs six or more vertebrae in front of the first broadened hypophyses; thus the air bladder does not actually enter the haemal arch but enters a modified haemal arch farther posteriorly where the vertebral hypophyses are more or less broadened.

One cannot help but believe unless parallel evolution has occurred that these American Atherinopsinae with air bladder and specialized vertebrae are related to the European Atherininae and may have been derived from a common ancestral type. Indeed, it would be interesting to have specimens of the species of the African Atherinidae for examination in regard to these fundamental characters.

Thus restricted, all those other American genera with unmodified vertebrae and the air bladder ending abruptly and not extending into the haemal arches as described above must be referred to a new subfamily, the Menidiinae, erected for their reception.

#### Genus AUSTROMENIDIA Hubbs

FIGURES 4a, 5c

- Austromenidia* HUBBS, Proc. Acad. Nat. Sci. Philadelphia, vol. 69, p. 307, 1918 (genotype: *Basilichthys regillus* Abbott=*Atherina regia* Humboldt).  
*Atherinichthys* (in part but not of Bleeker) GÜNTHER, Catalogue of the fishes of British Museum, vol. 3, p. 402, 1861 (emended spelling).  
*Basilichthys* of authors (not of Girard 1854) EVERMANN and RADCLIFFE, U. S. Nat. Mus. Bull. 95, p. 47, 1917.  
*Menidia* EIGENMANN (not Bonaparte), Rep. Princeton Univ. Exped. Patagonia, vol. 3, p. 290, 1909.  
*Cauque* EIGENMANN, Mem. Nat. Acad. Sci., vol. 22, Mem. 2, p. 56, 1927 (genotype: *Chirostoma mauleanum* Steindachner).  
*Patagonina* EIGENMANN, Mem. Nat. Acad. Sci., vol. 22, Mem. 2, pp. 56, 60, 1927 (genotype: *Patagonia hatcheri* [Eigenmann]=*Menidia hatcheri* Eigenmann, 1909, from Lake Pueyrredon, Patagonia).  
*Patagonia* EIGENMANN (*l. c.* in footnote, variation in spelling), same type (name preoccupied, however).

I have examined three specimens from Lake Llanquihue, the type locality of *Chirostoma mauleanum* Steindachner, labeled by Dr. Eigenmann as "*Cauque mauleanum* (Steind.)," now U. S. N. M. No. 84334, and I do not hesitate to place them in the genus *Austromenidia* Hubbs. One of these specimens had a vertebral count of 24+23 vertebrae. A

lot of *Menidia hatcheri* Eigenmann formerly part of Indiana University Museum No. 15301, now U. S. N. M. No. 121851, and from Laguna Fría, Lake Nahuel-Huapi, is referred to this genus. The generic diagnosis of this genus is based on numerous lots in the National collection including several species, among which are numerous specimens of *A. regia* (Humboldt), all from Peru, Chile, Argentina, including the Falkland Islands. A count made on *A. nigricans* from the Falkland Islands revealed 28+30 vertebrae.

The following species as recognized by Jordan and Hubbs are referred to this genus: *A. hatcheri* (Eigenmann); *A. regia* (Humboldt); *A. laticlavia* (Cuvier and Valenciennes); *A. gracilis* (Steindachner); *A. brevianalis* (Günther); *A. mauleanum* (Steindachner); *A. itatano* (Steindachner); *A. nigricans* (Richardson).

Upon writing to Dr. L. Bertin, Muséum National d'Histoire Naturelle, Paris, concerning the types of *Atherina jacksoniana* Quoy and Gaimard, I received the following information, which I greatly appreciate: There are four types measuring 62.5 (57), 71 (63), 73 (63), and 120.5 (105) mm., in total length, the standard length given in parentheses; origin of first dorsal fin equidistant between tip of snout and midbase of caudal fin; anus just in front of anal-fin origin; origin of first dorsal in front of anus; the latter about under rear base of this fin; body cavity not passing anal origin; ascending premaxillary process triangular; premaxillary protractile; no sheath of scales now present on bases of dorsal or anal fins; rays of first dorsal 7, second dorsal 12, anal 19, pectoral 13; vertebrae 28+31=59.

Gilbert P. Whitley (Proc. Linn. Soc. New South Wales, vol. 68, pp. 136-137, fig. 10, No. 2, 1943) redescribes and figures *Atherina jacksoniana* Quoy and Gaimard after examining the types at Paris. He states, "This species described from 'Port Jackson' by Quoy and Gaimard in 1825 has puzzled all later workers on Australian fishes because none of our Atherines has 18 anal rays or agrees in other particulars." Whitley states there are: Two rows of cheek scales; mandibular rami elevated; teeth distinct; gill rakers slender and numerous; scales 80; five rows of scales over lateral band; vent well behind tips of ventral fins and well before anal; pectorals with dusky tips; a broad silvery lateral band; about 12 or 13 dorsal and 18 anal rays. Both Whitley and Bertin agree that there are 12 or 13 rays in the second dorsal and 18 or 19 anal rays. Bertin in giving the vertebrae 28+31=59 conclusively casts this species out of most of the other genera of Atherinidae, except *Austromenidia*. In fact, none of the characters such as 80 scales, protractile premaxillaries, origin or insertion of all fins, position of anus, and especially the body cavity ending in front of the anal fin origin, given by Whitley or by Bertin disagree with that South American genus.



Tentatively, at least, I refer *Atherina jacksoniana* to the genus *Austromenidia*, but to know which species it must replace in that genus must await a revision of *Austromenidia* and further comparisons of the types of *A. jacksoniana*.

#### Genus LEURESTHES Jordan and Gilbert

FIGURES 4d, 5a

*Leuresthes* JORDAN and GILBERT, Proc. U. S. Nat. Mus., vol. 3, p. 29, 1880 (genotype: *Atherinopsis tenuis* Ayres).

The generic description in the key is based on numerous specimens of the genotype from California.

I have examined the two types of *Leuresthes crameri* Jordan and Evermann, U. S. N. M. No. 47583, and they belong in this genus and undoubtedly are the same species as *L. tenuis*.

It would be interesting to know if the remarkable development of the air bladder in this genus has some connection to the close correlation of the tidal cycle with the highly specialized spawning habits of *L. tenuis*, so fully described by Dr. W. F. Thompson and others.

#### Genus ODONTESTHES Evermann and Kendall

FIGURES 8, 9

*Odontesthes* EVERMANN and KENDALL, Proc. U. S. Nat. Mus., vol. 31, p. 94, fig. 3, 1906 (genotype: *Odontesthes perugiae* Evermann and Kendall).

*Kronia* RIBEIRO, Arch. Mus. Nac. Rio de Janeiro, vol. 17, Trematolepides, p. 9, 1915 (genotype: *Kronia iguapensis* Ribeiro).

*Pseudothyryna* RIBEIRO, Arch. Mus. Nac. Rio de Janeiro, vol. 17, Trematolepides, p. 11, 1915 (genotype: *Pseudothyryna iheringi* Ribeiro).

The generic diagnosis is based upon numerous specimens in the following lots in the National collections: The holotype of *Odontesthes perugiae*, U. S. N. M. No. 55572; U. S. N. M. No. 126660, another specimen of *perugiae*; and U. S. N. M. Nos. 1706, 55581, 77297, 84468, 122862, which probably are specimens of *bonariensis* or of a closely related species. Certain specimens of the last-named species have the dentition variable on the vomer, either present or absent, and I can find no good reason why *Kronia iguapensis* Ribeiro is not *bonariensis* or at least a closely related species, the status of which cannot be determined until the types of Ribeiro's species are reexamined. The dentition of the jaws in *O. perugiae* consists of two widely spaced rows of teeth, but in the material listed above and referred to *bonariensis* the teeth are variable, the two rows in some specimens as in *perugiae* but in others irregular, and even a third irregular row occurs between the two outer rows. The pikelike or pointed snout of *perugiae* is less pointed in *bonariensis*, even somewhat rounded in some specimens. Because of the overlapping of characters between the two kinds of



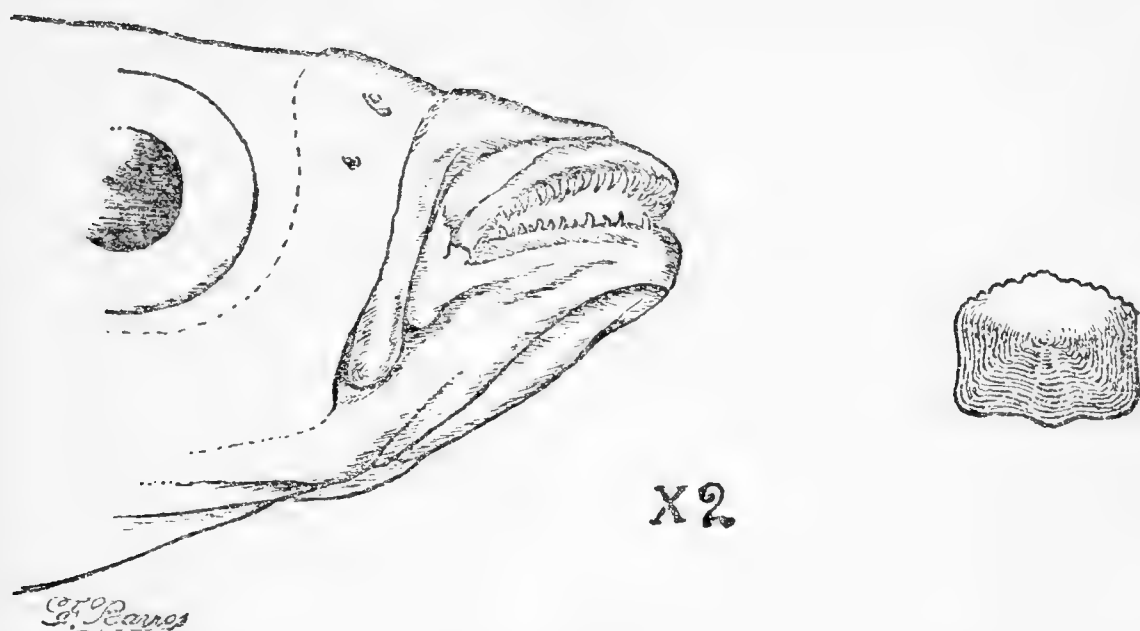


FIGURE 8.—A sketch by F. Barros of the head of the holotype of *Pseudothyryna iheringi*, furnished through the courtesy of Prof. Paulo M. Ribeiro.

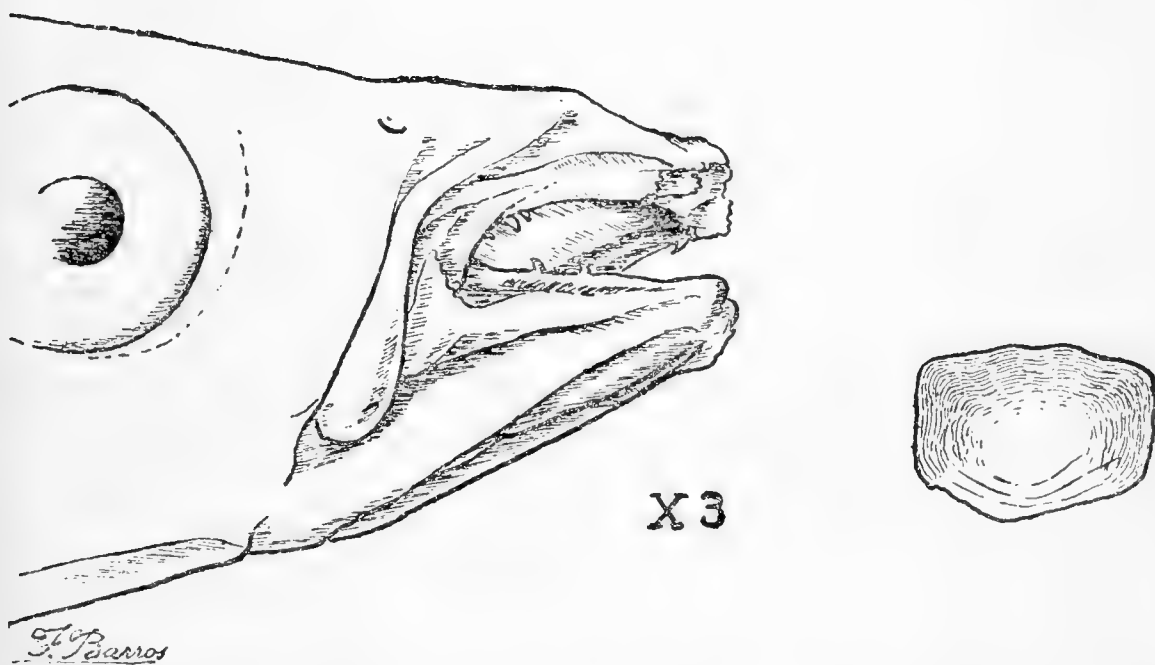


FIGURE 9.—A sketch by F. Barros of the head, with snout damaged, of the holotype of *Kronia iguapensis*, furnished through the courtesy of Prof. Paulo M. Ribeiro.

species, I have concluded that generically they should not be separated and that *Kronia* and *Pseudothyrina* belong in this group, and that they are not generically distinct from *Odontesthes*.

All counts given in the key were made on the specimens listed above and involved 10 counts for fin rays.

Both specimens of *O. perugiae* had IV-I, i, 7 dorsal rays, and I, i, 13 and I, i, 14 anal rays.

On May 1, 1945, I wrote to Prof. Paulo de Miranda Ribeiro, Museu Nacional, Rio de Janeiro, and in a letter dated June 25 I received from him the following information concerning the genotypes of *Pseudothyrina* and *Kronia* (figs. 8, 9), and for this data I express my sincere thanks to him:

The type, only known specimen, of *Pseudothyrina iheringi* Ribeiro has the body cavity extending into the haemal canal; the origin of first dorsal one and one-half series of scales in front of the origin of anal fin; origin of the second dorsal over eleventh ray of anal. "Teeth disposed irregularly, especially on lower jaw (mandible) giving the impression of bands, tending however to arrange themselves into two series (especially on the maxilla); they are conical, curved, and strong; the first series placed close to margin of jaw, there being between this series and the next a space that would serve for location of another series; I came across no vomerine teeth." The following counts were sent: "1st dorsal 4; 2d dorsal  $9\frac{1}{2}$ ; anal 18; pectoral 15; lateral line 53; vertical [scale row] under 1st ray of 2d dorsal, 9; under 1st ray of 1st dorsal, 11." The belly was compressed, and no sheath of scales was observed along the anal base.

I find no outstanding differences that separate *Pseudothyrina* from *Odontesthes* and therefore refer it to the synonymy of the latter genus.

The following was furnished from the type, only known specimen, of *Kronia iguapensis* Ribeiro: "The body cavity reaches half the distance between the anus (vent) and first anal ray, then narrowing and penetrating the haemal channel (canal)." He says that the first ray of the second dorsal fin is over the fourteenth anal ray; the distance from the first ray of first dorsal to first ray of second dorsal is contained four times in the distance from tip of snout to first dorsal origin; the first ray of first dorsal is over the anus. "The dentition is a good deal damaged, placing difficulties to a good understanding thereof; we can, however, say that it consists of relatively long teeth, conical and slightly curved inwards and tending to form two series, the exterior being implanted close to the [outer] border of the jaws and the second removed by a space that would permit the implantation of another series; all the teeth on the mandible are broken; those of the second [inner row] tending same way. Those on the vomer seem to have been placed in series, but I cannot be positive." Other notes indicate that what scales are left appear to have smooth

margins; although the tip of the snout is badly damaged, it overlaps the lower jaw. The belly is rounded, and there are a few scales forming a short sheath anteriorly along anal-fin base opposite no more than the first seven anal rays. The following counts I quote: "Anal 21 rays; pectoral 14; 2d dorsal  $8\frac{1}{2}$ ; 1st dorsal 5; an exact [scale] count impossible, many scales are missing; lateral line 60?; vertical [row] under 1st dorsal 11, and 9 under second."

Since I find no outstanding difference between *Kronia* and *Odon-testhes*, the former becomes a synonym.

#### Genus HUBBSIELIA Breder

*Hubbsiella* BREDER, Bull. Bingham Oceanogr. Coll., vol. 2, art. 3, p. 6, figs. 2-4, 1936 (genotype: *Menidia clara* Evermann and Jenkins=*Atherina sardina* Jenkins and Evermann).

My generic diagnosis as given in the key was based on the holotype of *Menidia clara* Evermann and Jenkins, U. S. N. M. No. 43237, from the Bay of Guaymas, and on one other specimen, U. S. N. M. No. 123210, from the mouth of the Colorado River. In addition, I made an incision in the type of *Atherina sardina* Jenkins and Evermann, U. S. N. M. No. 39633, and found that the air bladder tapers to a point in the haemal canal, and that the hypophyses of the vertebrae are broadened the same as in *M. clara*. There are 54 scale rows along the sides of the body instead of 45, as given by Jenkins and Evermann. I conclude, therefore, that *M. clara* is a synonym of *A. sardina*, both coming from the same locality.

This genus is closely related to *Leuresthes*, the two being undoubtedly in the same phyletic line. It is not closely related to *Hubbesia gilberti*, this form having an entirely different air bladder, thus being in a different phyletic line, contrary to the opinion of Dr. C. L. Hubbs as expressed in Breder's description of the genus *Hubbsiella*.

#### Genus BASILICHTHYS Girard

*Basilichthys* GIRARD, Proc. Acad. Nat. Sci. Philadelphia, vol. 7, p. 198, 1854 (genotype: *Atherina microlepidota* Jenyns).

*Protistius* COPE, Proc. Acad. Nat. Sci. Philadelphia, vol. 26, p. 66, 1874 (genotype: *Protistius semotilus* Cope) (ref. copied).

*Gastropterus* COPE, Proc. Amer. Philos. Soc., vol. 17, p. 700, 1878 (genotype: *Gastropterus archaeus* Cope).

*Pisciregia* ABBOTT, Proc. Acad. Nat. Sci. Philadelphia, vol. 51, p. 342, 1899 (genotype: *Pisciregia beardsleei* Abbott).

The generic diagnosis in the key was based on specimens of *B. microlepidotus* from Chile, as well as on other species. The specimens of this genus examined are U. S. N. M. Nos. 77355, 77356, 83646, 84327, and 84331.

*B. australis* Eigenmann belongs in this genus, along with *microlepidotus* Jenyns, *semotilus* Cope, *beardsleei* Abbott, and *archaeus* Cope.

Genus *ATHERINOPSIS* Girard

*Atherinopsis* GIRARD, Proc. Acad. Nat. Sci. Philadelphia, vol. 7, p. 134, 1854 (genotype: *Atherinopsis californiensis* Girard).

My generic diagnosis is based on numerous specimens of *A. californiensis* from California as follows: types, U. S. N. M. Nos. 351 and 352; and the following nontype material: U. S. N. M. Nos. 354, 17015, and 24882.

I have examined the holotype of *Atherinopsis sonorae* Osburn and Nichols, U. S. N. M. No. 87544, and it belongs in this genus.

Genus *ATHERINOPS* SteindachnerFIGURE 1*d*

*Atherinops* STEINDACHNER, Sitz. Akad. Wiss. Wien, vol. 72, p. 89 (p. 61 in reprint), 1875 (genotype: *Atherinopsis affinis* Ayres).

*Colpichthys* HUBBS, Proc. Acad. Nat. Sci. Philadelphia, vol. 69, p. 67, 1918 (genotype: *Atherinops regis* Jenkins and Evermann).

The generic diagnosis is based on numerous specimens of *A. affinis* from California: U. S. N. M. Nos. 15036, 17019, 17020, 26680, 54790, 73672, 83558, 121847, and 125271.

In addition, U. S. N. M. Nos. 67292, 119315, and 125329 are specimens of *A. regis* from the Gulf of California. The three types of *A. regis* Jenkins and Evermann, U. S. N. M. No. 39632, have been examined, and I fail to find any good reason why the genus *Colpichthys* was needed.

*Atherinops oregonia*, holotype U. S. N. M. No. 74762, has been examined and belongs in this genus, along with the following species or subspecies: *affinis*, *littoralis*, *magdalenae*, *insularum*, *cedroscensis*, and *guadalupae*.

## EXPLANATION OF PLATES

The plates are reproductions of part of the figures on plates 6 to 10 of Clementina Borsieri's paper in *Annali di Agricoltura* for 1902, No. 233, published in 1904, on the species of *Atherina* of Europe.

## PLATE 1

- 1, *Atherina hepsetus* Linnaeus: *a*, Four of the haemal arches; *b*, premaxillaries and maxillaries; *c*, dorsal view of head.
- 2, *Hepsetia boyeri* (Risso): *a*, Premaxillaries and maxillaries; *b*, four of the haemal arches.

## PLATE 2

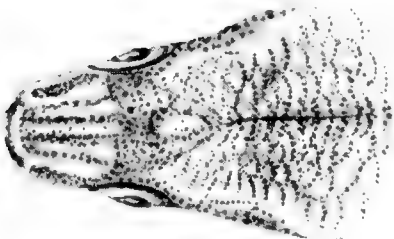
- 1, *Atherina presbyter* Cuvier and Valenciennes: *a*, Five of the haemal arches; *b*, premaxillaries and maxillaries.
- 2, *Hepsetia mochon* (Cuvier and Valenciennes): *a*, Four of the haemal arches; *b*, premaxillaries and maxillaries.
- 3, *Hepsetia rissoi* (Cuvier and Valenciennes): *a*, Premaxillaries and maxillaries; *b*, four of the haemal arches.



1a



1b



1c

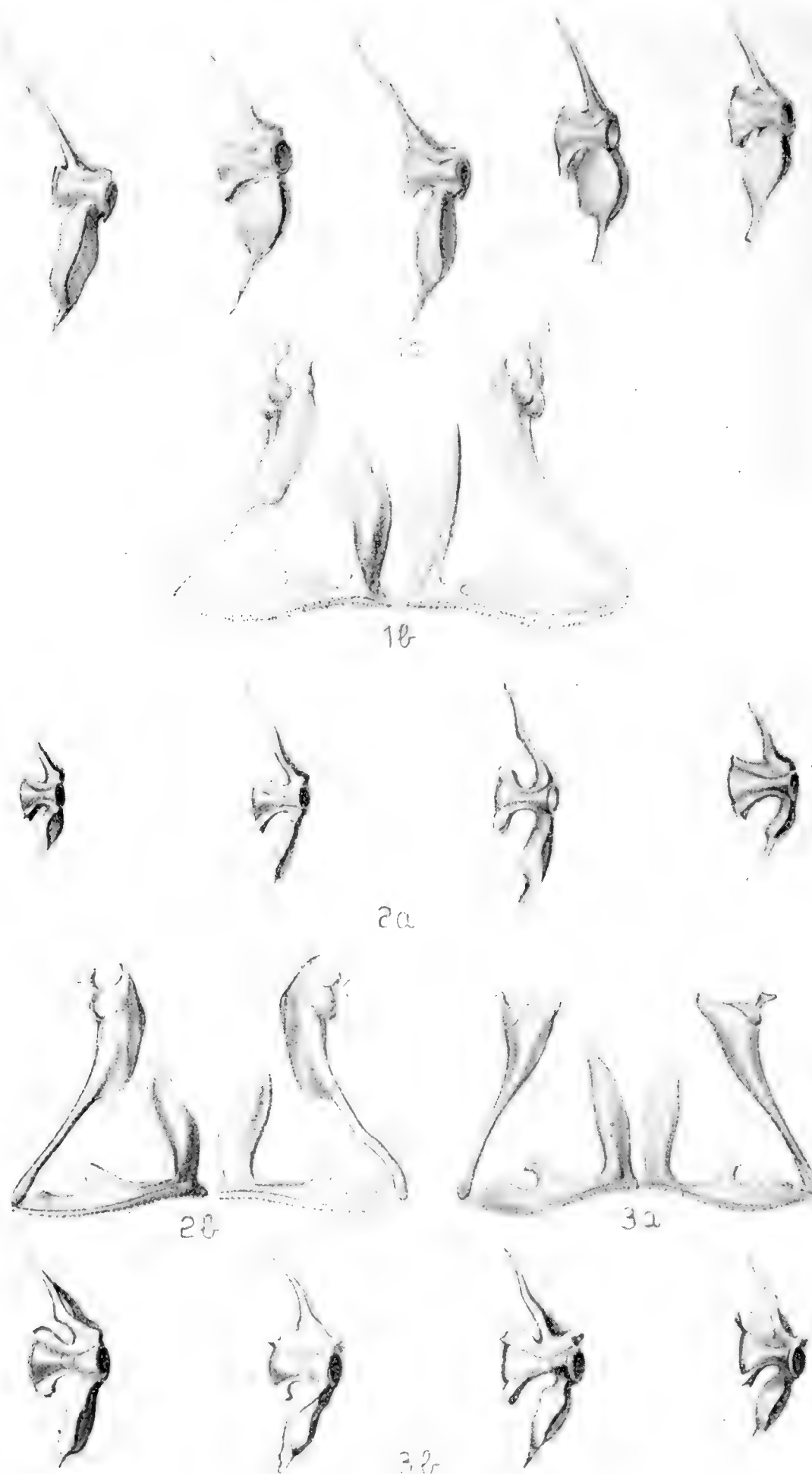


2a



2b

(For explanation see page 48.)



(For explanation see page 48.)



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## MAMMALS OF NORTHERN COLOMBIA

### PRELIMINARY REPORT NO. 3: WATER RATS (GENUS *NECTOMYS*), WITH SUPPLEMENTAL NOTES ON RELATED FORMS

By PHILIP HERSHKOVITZ

Water rats obtained in northern Colombia by the author during his 1941-1943 tenure of the Walter Rathbone Bacon Traveling Scholarship number 12 specimens of an undescribed race of *Nectomys squamipes* and 4 specimens of *Nectomys alfari russulus*. Both series were taken in the same trap line in the Río Tarra region, upper Río Catatumbo, department of Norte de Santander. This is the first recorded occurrence of two species of *Nectomys* in the same locality and supplies further evidence that the Lake Maracaibo drainage basin is an area where interchange between trans- and cis-Andean mammalian faunas takes place. Extensive trapping for small rodents failed to yield water rats in other Colombian localities where collecting was done. However, several specimens of *Nectomys squamipes* from the Cauca and upper Meta regions, generously donated by Hermano Nicéforo María, of the Instituto de La Salle, Bogotá, furnish important additions.

Present material serves to dispose of some taxonomic problems left unclarified in the writer's review (1944) of the genus *Nectomys*. In addition, the types of the species described by Thomas as *Nectomys dimidiatus*, *Nectomys hammondi*, and *Nectomys saturatus*, which were referred to the "*incertae sedis* group" (1944, p. 80), have been examined recently in the British Museum. The first two prove to be unique members of the genus *Oryzomys*. The last is a subspecies of *N.*

*squamipes*. Other types examined in the British Museum reveal that *Nectomys fulvinus* Thomas and *N. grandis* Thomas were correctly referred by the writer to *N. squamipes*, the first as a synonym of *N. s. apicalis*, the second as a subspecies. It was discovered also that *O. barbacoas ochrinus* Thomas is practically identical with *Nectomys (Sigmodontomys) alfari esmeraldarum*. The original *Oryzomys barbacoas* Allen, in the American Museum of Natural History, also is referable to *N. a. esmeraldarum*.

The above-named forms and the additional Colombian material are discussed more fully below. Thanks are expressed to the authorities of the American Museum of Natural History for permission to describe as new a specimen of *Nectomys* not identified in the writer's earlier report on the genus. Capitalized color terms are from Ridgway ("Color Standards and Color Nomenclature," Washington, 1912). Northern Colombian localities mentioned in the text are shown on the map accompanying the first preliminary report of this series (Proc. U. S. Nat. Mus., vol. 97, fig. 1, 1947).

#### NECTOMYS SQUAMIPES APICALIS Peters

*Nectomys apicalis* PETERS, Abh. Akad. Wiss. Berlin, 1861, p. 152, pl. 1, fig. 1, pl. 2, figs. 3-3b (type locality, "Guayaquil"; redetermined as Tena, eastern Ecuador, by Hershkovitz, Mus. Zool. Univ. Michigan Misc. Publ. No. 58, p. 25, 1944).

*Nectomys fulvinus* THOMAS, Ann. Mag. Nat. Hist., ser. 6, vol. 19, p. 499, 1897 (type locality, "Quito"; redetermined as eastern Ecuador, probably near Tena, by Hershkovitz, *op. cit.*, p. 26).

*Nectomys squamipes apicalis*, HERSHKOVITZ, Mus. Zool. Univ. Michigan Misc. Publ. No. 58, pp. 25, 52, 1944 (characters, distribution, synonymy).

*Nectomys squamipes* subspecies I, HERSHKOVITZ, Mus. Zool. Univ. Michigan Misc. Publ. No. 58, p. 65, 1944 (Colombia: Villavicencio, Meta; Guaicaramo, north-east of Villavicencio; Medina, eastern Cundinamarca; Mambita, eastern Cundinamarca).

The specimens from the upper Río Meta, contributed by Hermano Nicéforo María, include three individuals from Medina (only one adult) and an adult from Guaicaramo. They do not reveal more than has been described (Hershkovitz, *op. cit.*, p. 65). They show no near relationship to the water rats collected by the author in the Lake Maracaibo Basin of northern Colombia. It seems best, therefore, to refer the eastern Colombian rats to *apicalis*, the form they resemble most.

The type specimen of *Nectomys fulvinus* Thomas, in the British Museum, is a "tawny phase" individual. This accounts for its having been originally distinguished "from all others by its deep fulvous color which more nearly resembles that of some of the *Couesi* group of *Oryzomys*." It agrees completely with eastern Ecuadorian *apicalis*



of which three "tawny phase" females were recorded by the writer (*op. cit.*, p. 36). A previously overlooked quotation by Tomes throws further light on the true origin of the type specimen of *fulvinus* which was purportedly collected in Quito by Jamieson. In recording "*Diphylla ecaudata*," Tomes (Proc. Zool. Soc. London, 1860, p. 212) inserted the following note by Fraser: "'Rio Napo. *Murcielago*. The specimen was taken by the son of Professor Jamieson in the act of drawing blood from a man.'"

NECTOMYS SQUAMIPES GRANDIS Thomas

*Nectomys grandis* THOMAS, Ann. Mag. Nat. Hist., ser. 6, vol. 19, p. 498, 1897 (type locality, Concordia, lower Río Cauca Valley, Antioquia, Colombia).

*Nectomys squamipes grandis*, HERSHKOVITZ, Mus. Zool. Univ. Michigan Misc. Publ. No. 58, pp. 29, 62, 1944 (description).

A specimen from the Río Cauca, "south of Medellín," presented by Hermano Nicéforo María, may be regarded as typical. It had been mounted and displayed in the museum of the Instituto de La Salle. The skull, in imperfect condition, has the following dimensions: Zygomatic width, 24.4; width across parietal ridges, 13.7; alveolar length of molar row, 7.3; interparietal,  $10.2 \times 5.0$  mm. The nasals (tips broken) are as in *N. squamipes magdalenae*, less tapered than in *apicalis*. In external characters, the specimen more nearly resembles Ecuadorian than eastern Colombian representatives of *apicalis*.

NECTOMYS SQUAMIPES SATURATUS Thomas

*Nectomys saturatus* THOMAS, Ann. Mag. Nat. Hist., ser. 6, vol. 20, p. 546, 1897 (type locality, Ibarra, Imbabura Province, Ecuador).—HERSHKOVITZ, Mus.

Zool. Univ. Michigan Misc. Publ. No. 58, pp. 21, 22, 81, 1944 (*incertae sedis*).

Examination of the type in the British Museum shows it to be a member of the typical species. The type is in old pelage; condylobasal length, approximately 44; interparietal,  $6 \times 12$  mm.

NECTOMYS SQUAMIPES TARRENSIS, new subspecies

*Holotype*.—Adult male, skin and skull, U. S. N. M. No. 279741; collected August 6, 1943, by Philip Hershkovitz; original number 2319.

*Type locality*.—Río Tarra, upper Río Catatumbo, department of Norte de Santander, Colombia; altitude, 250 meters.

*Distribution*.—Known only from the type locality. It probably occurs at least throughout the eastern foothills of the Sierra de Perijá and the lowlands of the southwestern portion of the Lake Maracaibo Basin.

*Characters*.—Nearest *melanius* in size, color, and cranial characters; pelage thick and glossy, underparts paler, with more yellow, especially on forelegs and chin; tail brown with gray keel hairs in older individ-

uals; proportion of length to width of interparietal less than in *melanius*, average 25.9 percent (22–31 percent, nine adult specimens).

*Coloration of holotype*.—Dorsal surface Orange-Buff mixed with Prout's Brown; sides of body and face nearly uniformly Orange-Buff. Ventral surface of body irregularly washed with Antimony Yellow and Light Ochraceous-Buff, the pale gray subterminal bands of the hairs showing through. Outer sides of fore and hind feet like sides, inner sides, chin, pale gray lightly washed with Naples Yellow. Upper surface of fore and hind feet brown thinly covered with silvery hairs. Tail brown with gray keel hairs.

*Measurements* (in millimeters).—Those of the holotype followed by the means and extremes of the nine adult paratypes. Head and body, 223, 204.2 (186–223); tail, 194, 185.2 (167–198); hind foot, 48, 49.4 (47–54); ear, 24, 23.1 (22–25); condylobasal length, 41.3, 40.3 (37.2–41.5); zygomatic breadth, 24.1, 22.8 (22.2–24.1); nasals, length, 19.1, 17.7 (16.1–19.1); width across temporal ridges, 13.7, 14.3 (13.7–14.8); alveolar length of molar row, 6.8, 7.1 (6.8–7.2); interparietal,  $3.7 \times 12.7$ ,  $3.2 \times 12.4$  ( $2.7\text{--}3.7 \times 11.4\text{--}12.9$ ).

*Specimens examined*.—Twelve (8 males, 4 females), all from the type locality.

*Remarks*.—The discovery of this race of *Nectomys squamipes*, with the assignment of the upper Río Meta rats to *apicalis*, isolates the specimens previously recorded under the heading *Nectomys squamipes* subspecies II as a well-defined geographic race.

#### NECTOMYS SQUAMIPES TATEI, new subspecies

*Nectomys squamipes* subspecies II, HERSHKOVITZ, Mus. Zool. Univ. Michigan Misc. Publ. No. 58, p. 66, 1944.

*Holotype*.—Adult female, skin and skull, A. M. N. H. No. 69899; collected April 22, 1925, by G. H. H. Tate and Harold J. Clement; original number 3424.

*Type locality*.—San Antonio, about 15 km. east of Mount Turumiquire, Sucre, northern Venezuela; altitude 1,800 feet.

*Distribution*.—Known only from the type locality and from La Latal, northwest of Mount Turumiquire, in the semiarid coastal range of northern Venezuela.

*Characters* (of the type and only adult specimen).—Color similar to that of eastern Colombian representatives of *N. s. apicalis*; dorsal surface Ochraceous-Orange with a more or less even mixture of Prout's Brown; underparts gray, the belly and chest washed with ochraceous; tail uniformly brown, longer than combined length of head and body; interparietal as in *apicalis*; alveolar length of molar row shorter; nasals behind as in *N. s. melanius*.

*Measurements* (in millimeters).—Head and body, 180; tail, 200; hind foot (dry, with claw), 48.0; condylobasal length, 39.1; zygomatic breadth, 22.2; length of nasals, 17.5; width across parietal ridges, 13.6; alveolar length of molar row, 7.1; interparietal,  $4.5 \times 9.3$  (48 percent).

*Remarks*.—The type is paler than *N. s. melanius* and *tarrensis*, most nearly related to eastern Colombian representative of *apicalis* and widely different from *palmipes* of the island of Trinidad, its nearest geographic ally. It represents a restricted race and, like *tarrensis*, appears to be well isolated from its wide-ranging neighbors, *melanius* and *apicalis*.

This water rat is named for Dr. G. H. H. Tate, of the American Museum of Natural History and one of the co-collectors of the type specimen.

*Specimens examined*.—Two. The type and a juvenal from La Latal, both in the collection of the American Museum of Natural History.

#### NECTOMYS (SIGMODONTOMYS) ALFARI RUSSULUS Thomas

*Nectomys russulus* THOMAS, Ann. Mag. Nat. Hist., ser. 6, vol. 20, p. 547, 1897 (type locality, Valdivia, lower Cauca Valley, Antioquia, Colombia).

*Nectomys alfari russulus*, HERSHKOVITZ, Mus. Zool. Univ. Michigan Misc. Publ. No. 58, p. 77, 1944 (subgenus *Sigmodontomys*).

*Nectomys alfari* near *russulus*, HERSHKOVITZ, Mus. Zool. Univ. Michigan Misc. Publ. No. 58, p. 77, pl. 4, figs. 1-2, 1944 (La Azulita, Venezuela).

Four specimens were secured from the Tarra, a tributary of the upper Río Catatumbo in the Lake Maracaibo drainage basin. They agree with the individual from the southeastern edge of the lake previously recorded as “near *russulus*.” All conform with the type of *russulus* in the more important cranial characters but may be shown to average darker in coloration when compared with more specimens from the typical locality. In the type specimen, the present series, and the Venezuelan specimen, the incisive foramina are comparatively widely open, wider behind than in front with the posterior borders rounded or nearly square, not pointed, the mesopterygoid fossa wider than length of first upper molar. The posterior border of the nasals is truncate in the type, obtusely to narrowly pointed in the others. Comparisons with the original series of *Nectomys alfari efficax* Goldman, from eastern Panama, confirm its subspecific distinction from *russulus*.

Measurements of the type specimen of *russulus*, taken in the British Museum, are as follows: Condylobasal length, 33.5; zygomatic breadth, 19.3; length of nasals, 13.9; width across parietal ridges, 12.7; alveolar length of molar row, 5.9; interparietal,  $3.5 \times 8.6$  mm. The type is slightly tawnier in coloration than the type of *esmeraldarum*.

## NECTOMYS ALFARI ESMERALDARUM Thomas

*Nectomys esmeraldarum* THOMAS, Ann. Mag. Nat. Hist., ser. 7, vol. 8, p. 250, 1901 (type locality, San Javier, Esmeraldas, northwestern Ecuador).

*Nectomys alfari esmeraldarum*, HERSHKOVITZ, Mus. Zool. Univ. Michigan Misc. Publ. No. 58, p. 78, 1944 (Ecuador: San Javier, Esmeraldas; Carolina, Río Mira, Imbabura).

*Oryzomys barbacoas* J. A. ALLEN, Bull. Amer. Mus. Nat. Hist., vol. 35, p. 85, 1916 (type locality, Barbacoas, Nariño, southwestern Colombia).

*Oryzomys barbacoas ochrinus* THOMAS, Ann. Mag. Nat. Hist., ser. 9, vol. 7, p. 449, 1921 (type locality, Ecuador, west of Quito).

The characters of the subgenus *Sigmodontomys* with its only species, *Nectomys alfari*, are such that its identification with *Oryzomys*<sup>1</sup> is not surprising. It will be recalled that Allen had previously described a member of his own *Sigmodontomys* as *Oryzomys ochraceus*. Thomas, after describing *russulus* and *esmeraldarum* and deliberating largely upon the characters and relationships of all known species of *Nectomys*, regarded *ochrinus* as "quite unlike anything in the British Museum collection." The type and topotype of *barbacoas* Allen are near enough, both geographically and in their characters, to be assigned to *esmeraldarum*. The type of *ochrinus* is more ochraceous than that of *esmeraldarum*, and quite like the specimens recorded by the writer (*op. cit.*) from Carolina, Río Mira, Ecuador. The original specimen of *ochrinus* "collected" by Söderström from "west of Quito" could very well have originated in the Río Mira region on the western slope of the Cordillera Occidental.

The type of *esmeraldarum* is a young adult. Its cranial measurements are given, followed by those of the type of *ochrinus*; condylo-basal length, 31.7, 31.9; zygomatic breadth, 17.9, —; length of nasals, 13.9, 13.7; width across parietal ridges, 12.0, 12.2; alveolar length of molar row, 5.2, 6.0; interparietal, 2.9×7.9, 3.8×8.7 mm.

## THE STATUS OF "NECTOMYS" DIMIDIATUS AND OF "NECTOMYS" HAMMONDI

Of the three species previously listed in the "*incertae sedis*" group (Herskovitz, 1944, pp. 21, 80), one, *Nectomys saturatus*, is shown above to be a race of *squamipes*. The other two, *dimidiatus* and *hammondi*, are very different from each other and from *Nectomys*. Examination of the types, the only known specimens, reveals them to be specially marked members of the genus *Oryzomys* neither of which is assignable to any known superspecific group. Each represents a

<sup>1</sup> It may be better to regard *Sigmodontomys* as a subgenus of *Oryzomys*. Likewise, most of the oryzomyine rodents, including *Nectomys*, *Oecomys*, *Oligoryzomys*, *Microryzomys*, *Melanomys*, *Nesoryzomys*, and *Megalomys*, can be incorporated with *Oryzomys* as subgenera. Pending further revisionary work, however, it is convenient to follow the earlier classifications.

distinct diversification within the genus. Their relationship to each other and to the remaining species of oryzomyine rodents is best expressed by conferring subgeneric rank upon them.

The oryzomyine characters common to the two forms described below have been given, and the dental terminology used here has been defined (*op. cit.*, pp. 12-17).

MICRONECTOMYS, new subgenus (genus *Oryzomys*)

*Type species.*—*Nectomys dimidiatus* Thomas, Ann. Mag. Nat. Hist., ser. 7, vol. 2, p. 586, 1905 (type locality, Río Escondido, 7 miles below Rama, Nicaragua); Hershkovitz, Mus. Zool. Univ. Michigan Misc. Publ. No. 58, pp. 21, 22, 80, 1944.

*Description of type species.*—Externally similar to a young *N. squamipes*; smaller than *N. alfari*, with tail less than combined length of head and body; gray keel hairs well developed as in typical adult *Nectomys*; webs between toes of hind feet reduced, as in *N. alfari*; other external characters as originally described. Skull more lightly built than in *Nectomys*, rather as in typical *Oryzomys*; supraorbital ridges little developed, brain case broad, smooth and rounded; nasals behind not markedly narrowed, the ends obtusely pointed; incisive foramina well opened, wider behind than in front, the posterior border extending slightly behind anterior plane of  $M^1$ ; mesopterygoid fossa broad, its palatal width greater than crown length of  $M^1$ ; median border of alveolar branch of maxilla behind  $M^3$  projecting as a ledge over posterolateral palatine fossa, the palatamaxillary suture at this place coursing on internal wall of fossa and hidden from the ventral aspect; sphenopalatine vacuities present; mastoid process of squamosal long and delicate, as in *Oryzomys*; zygomatic plate wide but less projecting than in typical *Nectomys*. Molars of type much worn and details of enamel pattern difficult to determine but clearly less simplified than in *Nectomys*. Shape and general proportions of molars as in *N. alfari*; first upper molar with an anterior median fold; in  $M^{1-3}$  first internal folds discreet (coalesced with first primary folds in *Nectomys*); second internal folds probably coalesced with second primary folds in unworn teeth; second secondary fold possibly present in  $M^3$ ; anterior median fold of first lower molar well developed; internal folds 1 and 2 present in  $M_1$ , possibly present in  $M_{2-3}$ .

*Measurements of the type* (in millimeters).—Head and body, 125; tail, 115; hind foot, 28; ear, 13; condylobasal length, 27.2; zygomatic breadth, 17.0; length of nasals, 11.5; alveolar length of molar row, 4.3; least interorbital width, 5.3; width of zygomatic plate, 3.5; interparietal,  $2.8 \times 7.5$ ; crown length of  $M^1$ , 1.9.

MACRURORYZOMYS, new subgenus (genus *Oryzomys*)

*Type species*.—*Nectomys hammondi* Thomas, Ann. Mag. Nat. Hist., ser. 8, vol. 12, p. 570, 1913 (type locality, Mindo, Pichincha Province, northwestern Ecuador); Hershkovitz, Mus. Zool. Univ. Michigan Misc. Publ. No. 58, pp. 21, 22, 81, 1944.

*Description of type species*.—A large, extremely long-tailed member of the genus resembling *Nectomys alfar* in color and character of pelage; fifth hind toe, without claw, extending to base of second phalanx of fourth toe; other external characters as originally described. Nasals broad in front, not markedly tapering behind, the posterior borders meeting obtusely; zygomatic plate wide but only slightly forward-projecting as seen from above; supraorbital region nearly parallel-sided, the edges slightly raised and overhanging; interparietal large; walls of sphenopalatine fossa not fenestrated; palate comparatively simple, the posterolateral fossae and pits but little developed. Molars large, cusps high, the folds between narrowly compressed but open at the crown margins; first internal folds present in upper and lower molars, the second internal folds in the lower molars only; no discreet anterior median fold evident; minor folds of  $M_{1-3}$  well developed.

*Measurements of the type* (in millimeters).—Head and body, 203; tail, 251; hind foot, 32; ear, 18; condylobasal length, 38.8; zygomatic breadth, 21.2; length of nasals, 16.0; alveolar length of molar row, 6.9; least interorbital breadth, 6.9; width of zygomatic plate, 5.0; interparietal,  $5.4 \times 10.9$ ; width across parietal ridges, 14.0; incisive foramina,  $3.3 \times 6.3$ ; crown dimensions of first upper molar,  $2.3 \times 3.1$ .

*Remarks*.—The Costa Rican *Oryzomys aphaestus* Harris (Mus. Zool. Univ. Michigan Occ. Pap. No. 248, p. 5, 1932) is probably most nearly related to *O. hammondi*.

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1944. A systematic review of the Neotropical water rats of the genus *Nectomys* (Cricetinae). Mus. Zool. Univ. Michigan Misc. Publ. No. 58, 88 pp., 4 pls., 5 figs., 2 maps.



# PROCEEDINGS OF THE UNITED STATES NATIONAL MUSEUM



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## A POTENTIAL SNAIL HOST OF ORIENTAL SCHISTOSOMIASIS IN NORTH AMERICA (*POMATIOPSIS LAPIDARIA*)

By R. TUCKER ABBOTT

THE recent preliminary experimental work of Horace W. Stunkard (1946) has shown that the snail *Pomatiopsis lapidaria* (Say) is capable of serving as intermediate host, at least to the sporocyst stage, of the Oriental human blood fluke, *Schistosoma japonicum* Katsurada. It is possible that further experiments, particularly through the infection of young snails, will prove successful. Malacological studies indicate that this North American snail is strikingly similar to the known Oriental carriers in the genus *Oncomelania*; hence we are holding it at present under suspicion as a potential carrier.

Whether or not, with the accidental introduction of schistosomiasis into this country, this snail would become of medical importance in the future, it seems wise at this time to record what we know of its distribution, habits, and morphology. At present, the danger of an outbreak is remote. The epidemiological conditions in this country are not favorable for the spread of this type of disease, and laboratory infections of the snail are not necessarily a forecast of its activity in the field.

As an aid to public-health workers and parasitologists, we have gathered all the known locality records for this species and spotted the 170 stations on a map (fig. 10). A few records that represent excellent sources of material are given in detail; the other records are on file and available at the Division of Mollusks, United States National Museum, Washington 25, D. C.



Acknowledgments are due Dr. Henry van der Schalie, who kindly sent living specimens from which dissections were made. The majority of the locality records were sent by Dr. van der Schalie from the world's largest *Pomatiopsis* collection at the Museum of Zoology, University of Michigan. William J. Clench, curator of the department of mollusks, Museum of Comparative Zoology, at Cambridge, Mass., generously made his collection and its facilities available for part of this study. Dissections and bibliographic research were made both at Cambridge and at the division of mollusks at the United States National Museum.

## Family AMNICOLIDAE

### Subfamily HYDROBIINAE

The genus *Pomatiopsis* Tryon, 1862, is being placed in the family Amnicolidae and the subfamily Hydrobiinae. Various authors in the past have put *Pomatiopsis* in a subfamily and even family of its own. However, in all its characters, animal, shell, and operculum, it is properly a hydrobiine. We believe it should appear alongside the genus *Oncomelania*.

The genus *Pomatiopsis* in North America contains a number of species whose anatomical features have not as yet been investigated and a complete monograph will have to await further study. A catalog of the American species of *Pomatiopsis* is appended at the end of this paper.

#### POMATIOPSIS LAPIDARIA (Say)

*Cyclostoma lapidaria* SAY, Journ. Acad. Nat. Sci. Philadelphia, vol. 1, p. 13, 1817 (no locality).

*Amnicola (Pomatiopsis) lapidaria* SAY, TRYON, Proc. Acad. Nat. Sci. Philadelphia, 1862, p. 451.

*Pomatiopsis lapidaria* SAY, STIMPSON, Smithsonian Misc. Coll., vol. 7, No. 201, pp. 31-36, 1865.

*Description of shell*.—Adult shell 5 to 8 mm. (about one-fourth inch) in length, elongate-ovate, thin; color a translucent chocolate-brown to light yellowish brown. Nuclear whorls (developed in egg mass) 2 in number, rounded and glassy. Postnuclear whorls (developed after hatching) 4 to 5 in number, well rounded, smooth except for many small axial lines of growth. Suture between whorls well indented. Base of last whorl short, rounded, with a narrow, fairly deep umbilicus. On rare occasions an adult may have a slightly thickened outer lip of the aperture, though usually this aperture lip is thin and sharp. Operculum very thin, transparent, paucispiral, with eccentric nucleus and 2 to 3 whorls. (See pl. 3, figs. 3 and 4.)

The shell of *P. lapidaria* is strikingly similar to *Oncomelania nosophora* (Robson) of Japan and China, differing only in having the whorls more globose and the umbilicus larger and lacking in



most cases the varix or thickening just behind the outer lip of the aperture. The size, color, and texture of the shell, the early whorls, and the operculum are very much the same in appearance.

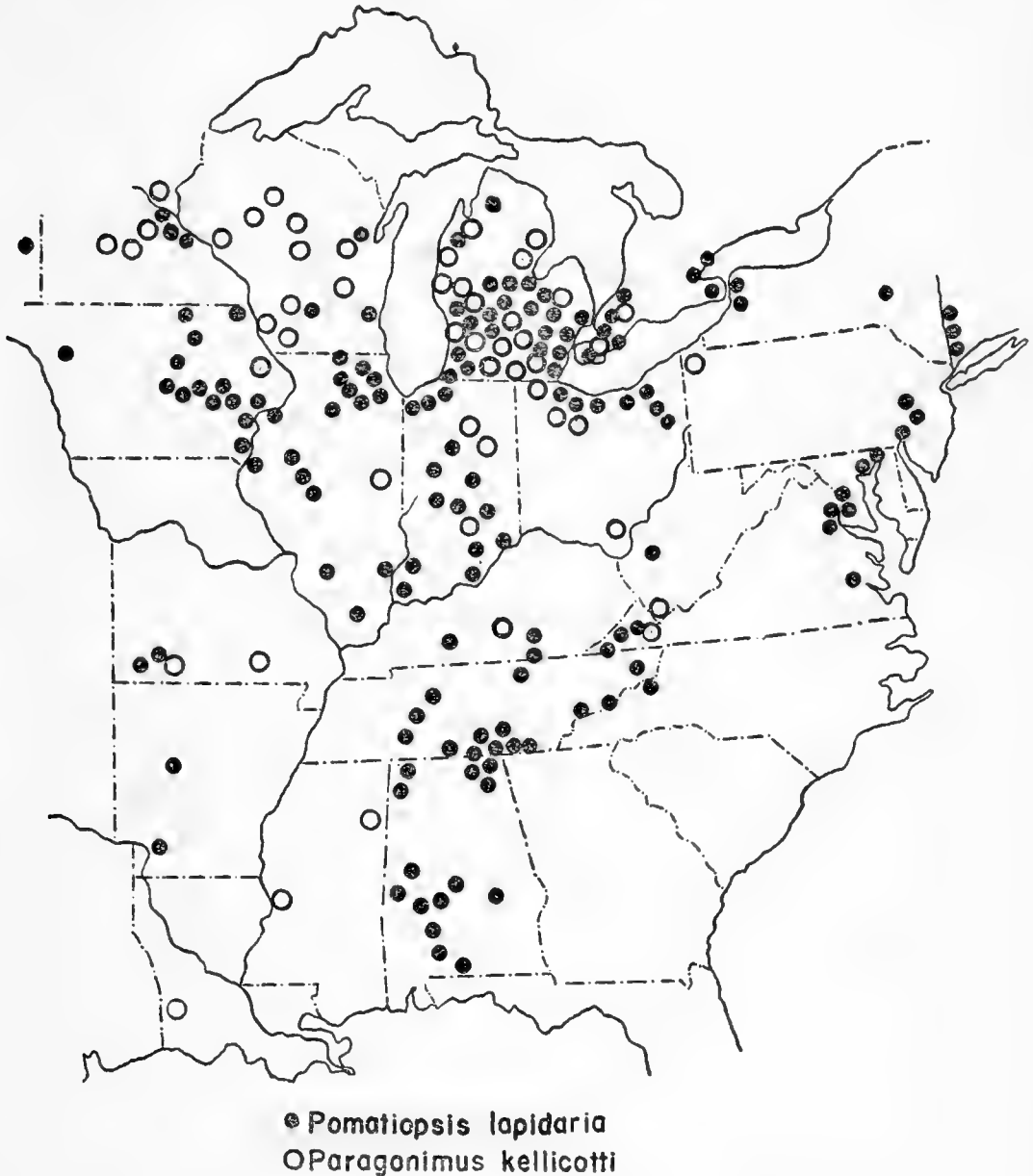


FIGURE 10.—Map showing distribution of the snail *Pomatiopsis lapidaria* (Say) (solid circles) and the disease it carries, *Paragonimus* (open circles; from Ameel, 1934).

*Animal* (pl. 3, figs. 1 and 2).—Animal small, with a simple foot, the underside of which is broad and short, rounded behind and truncate in front. Anterior edge of foot with a narrow, deep mucus slit to which may be seen leading a series of short mucus canal ducts. Head relatively small, proboscis or snout blunt, short bilobed in front. Single tentacle on each side of the head simple, slender, swollen at the outer base where the eye is located. In male specimens the verge or penis is located well behind the head on the dorsal side of the body and on the midline. Penis simple, with a single functional sperm duct.

There is considerable variation in its shape among males from the same locality, ranging from a simple, flattened, tapering cylinder to a prong with a "meat-chopper" blade on one side (see pl. 3, fig. 6, *a-d*). Mantle of animal thin, with a slightly thickened border. The gills or ctenidia consist of a series of 27 to 29 low, narrow lamellae or platelike flesh folds attached to the inner side of the mantle.

**COLOR:** In general a dark blackish gray. The most distinguishing color markings are the bright splotching of yellow or yellowish-white granularlike dots over each eye, forming false "eyebrows." Under-side of foot light slate-gray, peppered with minute white dots. Tentacles sandy brown to gray with a clear, colorless rim. Proboscis gray to gray-brown, with a narrow, clear rim on the anterior edge. The penis at its base is dusted with black specks, the remainder being a translucent yellowish gray.

The animal of the species is very similar to *Oncomelania nosophora* (Robson) and *O. hupensis* Gredler. Previous accounts of the divided foot and loping locomotion of *Pomatiopsis* are misleading. When crawling out of water the animals of *Oncomelania* and *Pomatiopsis* have the same type of motion, and both produce folds in the flesh of the foot due to the weight of the shell and body. In *Pomatiopsis* this is accentuated to such a degree that the foot appears divided. When immersed in water the folds disappear and locomotion is accomplished by gliding. The penis in *Oncomelania* is constantly a simple prong, while in *Pomatiopsis* a number of simple variations of this type are expressed in the form of side blades.

The yellow "eyebrows" in *Oncomelania* decrease in size and brightness the farther north the habitat. The yellowest and largest "eyebrows" are found in *O. quadrasi* (Möllendorff) of the Philippines, with those of *O. formosana* (Pilsbry and Hirase) of Formosa, *O. hupensis* of China, and *O. nosophora* of China and Japan becoming progressively whiter and smaller. *Pomatiopsis lapidaria* individuals from one colony express variation from almost no "eyebrow" coloring through distinctly yellow to a whitish yellow. This latter color is fairly common in a colony of living *O. nosophora* examined from Kurume, Chikugo Province, Kyushu Island, Japan.

The reproductive, nervous, and digestive systems of the two genera show few differences. Drawings of the central nervous system of *Pomatiopsis lapidaria* (Say) and *Oncomelania hupensis* Gredler are included. The latter was inadequately figured by Heude in 1882, and since Annandale (1924) attempted to compare it with other *Oncomelania* for systematic purposes, we are recording our findings to show that no significant difference of taxonomic importance can be found between the two genera. The central nervous systems of *Oncomelania quadrasi* figured by Abbott (1945), *O. nosophora* (Robson), and *O. hupensis* are almost identical.

Previously unrecorded in either *Oncomelania* or *Pomatiopsis* is a peculiar modification of the digestive system. Within the stomach is a thin, clear lining (of chitin?), which is crudely shaped into a corkscrew funnel. Flaps extending from the funnel line the walls of the stomach in its lower or posterior half. It has been observed in living and feeding snails that the mixture of food and sand, passing from the esophagus into the stomach, is forced through the center of the funnel, thus grinding the sand particles and food together. The contents swirl around at the rate of about 50 revolutions per minute. Within the lower part of the stomach and partially sheathed by the auxiliary flaps of this gastric sheath is a jellylike, elliptical, crystalline style, which in other mollusks is known to produce digestive enzymes. In *Oncomelania* the gastric sheath and crystalline style are more highly developed than in *Pomatiopsis*. *O. quadrasi* young were observed to pass food through the entire alimentary system in four minutes. While the swirling motion through the stomach continued as long as there was food present, the radula scraped periodically at the rate of 53 revolutions per minute. (See pl. 3, fig. 5.)

*Radula*.—The lingual ribbon or radula of this species is hardly distinguishable from that found in *Oncomelania hupensis* and *nosophora*. There are 92 to 95 rows of teeth on the ribbon, which is held together by a thin, transparent membrane bearing two side wings. Each row consists of a single rachidian (or central) tooth flanked closely on each side by first a lateral, then an inner marginal and lastly by an outer marginal tooth. Each tooth bears a characteristic number of tiny denticles. Radula counts in this paper refer to the number of denticles on each tooth. *P. lapidaria* from Ann Arbor, Mich., generally had a count of  $\frac{1-1-1}{3-3}$ ; 2-1-3; 7; 5, although the lateral occasionally varied on the same ribbon as 2-1-2 or 2-1-4. Some inner marginals had only 6 denticles. Specimens in Washington, D. C., usually had a rachidian count of  $\frac{1-1-1}{2-2}$ , although a few ran  $\frac{1-1-1}{3-3}$ . Many specimens of *Oncomelania hupensis* from Hung-Jao Road, Shanghai, China, have shown these same counts.

*Sexual dimorphism*.—Population studies on this species have shown a difference in the mean size of males and females. This is not unusual in many dioecious species, and in most of such cases the males are the smaller. The size difference in sexes and the mean size of the entire population vary from colony to colony. The histogram (fig. 11) represents the distribution of the length of adult males and females from one colony. The clear columns of the histogram, denoting males, have been added to the shaded areas denoting females, so that the histogram is a sum of both sexes. This population from Ann Arbor, Mich., produces a well-balanced, normal population curve, but in a colony from Grand Rapids, Mich., the lengths of the two

sexes are sufficiently different to create a bimodal curve, the males being the smaller. The bimodal curve is particularly accentuated in Philippine colonies of *Oncomelania quadrasi*, but almost absent in populations of *O. hupensis* in China. It is known that in certain marine genera, such as *Strombus*, one species characteristically shows sexual dimorphism, while other species in the same genus do not.

No studies have been undertaken to determine what role is played in causing this population variation by such factors as proportion of sexes, population size, availability of food, and distribution of multiple alleles. In the Philippines, where *O. quadrasi* lives in slow-running creeks and where little or no migration of individuals takes place, 0.5 to 1.0 mm. difference in mean length can be obtained from a number of discreet colonies of the same creek system.

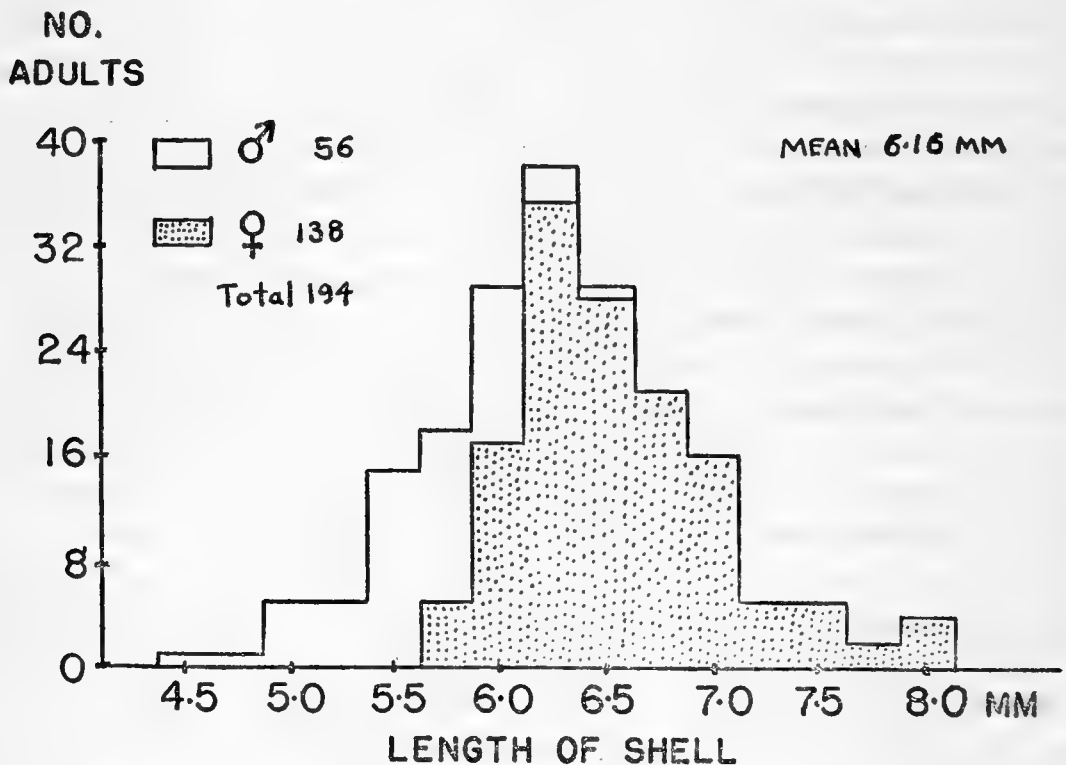


FIGURE 11.—Histogram of the shell length of a colony of adult *Pomatiopsis lapidaria* (Say) from Ann Arbor, Mich. Clear areas, denoting males, are added and not superimposed on shaded areas denoting females.

*Habitat and habits.*—This fresh-water species is even more amphibious in its habitat preference than *Oncomelania*, although in many respects it could be called the “*Oncomelania*” of North America. Like *Oncomelania*, it spends most of its time out of water in damp vegetation well protected from direct sunlight. When submerged in cool, running water, the animal apparently receives enough oxygen through its gills, and so it makes no attempt to leave the water. The eggs and egg-laying habits of this species are as yet unknown, although they probably lay eggs on moist surfaces at the water’s edge as do their relatives, *Oncomelania* (see Abbott, 1946). *P. lapidaria* is slightly nega-

tively phototropic, a condition unknown in *Oncomelania*. Adults can withstand one to two months' desiccation in shade at room temperature.

*Pomatiopsis lapidaria* occurs in colonies ranging from a few dozen to many thousand individuals. The colonies are usually found sporadically in moist shaded areas near fresh ponds, the banks of stream-cut glens or the overflow lowlands bordering a large river. They are able to tolerate a considerable amount of fine silt from large rivers, an accomplishment not known in *Oncomelania*. Very often colonies increase to noticeable size in the spring, flourish for a few seasons, and then with environmental changes are completely wiped out.

In their more terrestrial habitats their molluscan associates are the nonoperculate land genera *Polygyra*, *Cochlicopa*, *Succinea* (land snails), and *Agriolimax* (land slugs).

Copulation takes place in spring and early in summer. A few weeks later and during most of the summer young appear in the water.

**Range.**—Minnesota east through southern Ontario to southern New York. South to Alabama and Texas. Eastern Atlantic seaboard from Pennsylvania south to Virginia. No records in New England, the Carolinas, Georgia, or Florida. It has been unable to establish itself on or west of the Great Plains. Known also from loess deposits of the Pleistocene in the Midwest.

**Selected locality records** (also see map).—**CANADA: Ontario:** Along river bank about one-half mile upstream from bridge at Marsh's Mill, Aux Sables River, Arkona. **UNITED STATES: New York:** On moss and rocks at foot of American Falls, Niagara; Cruger, Dutchess County. **Michigan:** Mill Pond, one-quarter mile above Geddes, 4 miles southeast of Ann Arbor. **Alabama:** East side of tributary of Shoal Creek, 8½ miles northeast of Florence, Lauderdale County. **Maryland:** Margin of Susquehanna Flats, Havre de Grace, Harford County. **District of Columbia:** Woodland swamp on south bank of Potomac River, one-quarter mile southeast of Key Bridge; canal near Chain Bridge; Fox Ferry, Potomac River. **Virginia:** On wet rotten logs in swamp, Lanexa, New Kent County. **Pennsylvania:** Monocasy Creek, near Bethlehem, Northampton County. **Wisconsin:** Banks of Suamico River, 4 miles southwest of Suamico, Brown County.

**Parasitology.**—*Pomatiopsis lapidaria* (Say) was originally implicated as a first intermediate host of the North American lung fluke, *Paragonimus kellicotti* Ward, by D. J. Ameel in 1932. Other cercariae harbored by this snail are *Cercaria pomatiopsidis* Stimpson, 1865 (re-described by Ameel in 1939), *Cercaria geddesi* Ameel, 1939, *Cercaria marilli* Ameel, 1939, later shown (Ameel, 1944) to be the larval stage of *Nudacotyle novicia* Barker, and the cercaria of *Euryhormis monorchis* Ameel, 1938 (Ameel, 1939). Ameel found that adult snails could not be infected experimentally with *Paragonimus* miracidia, but

an infection of almost 100 percent was obtained in young snails of approximately 1 mm. in length. He reports that 78 to 93 days elapse between initial miracidial penetration and cercarial emergence. Cercarial shedding takes place in late afternoon or night. Stunkard (1946) reports that this species will harbor the larval stages of *Schistosoma japonicum* as far as the mature sporocyst stage.

*Oncomelania nosophora* (Robson) is one of the main intermediate hosts of *Schistosoma japonicum* in China and Japan, but it is also known to serve as host to *Paragonimus westermanii*, a close relative to *P. kellicotti* (Chen, 1941). This may indicate that *Oncomelania* and *Pomatiopsis* have a similar physiological constitution and that *Pomatiopsis* might possibly be capable of serving, at least experimentally, as an intermediate host of *Schistosoma japonicum*. It is well to remember, however, that these two species of *Paragonimus* have not been shown to be the same or distinct species. That one kind of mollusk plays host to a certain trematode does not necessarily mean that the same mollusk will serve as host for a closely related species of trematode. For example, one species of *Schistosoma* is carried by *Oncomelania* (a gill-bearing Streptoneura), another species by *Bulinus* (a lung-bearing Euthyneura). Care must be taken in the use of specificity homologies. Systematic relationships in mollusks are no key to the solution. Of primary importance, however, is the combination of suitable physiological environment and the ideal habitat or external environment of the snail. From this latter standpoint, *Pomatiopsis lapidaria* offers the most suitable conditions in North America for the introduction of *Schistosoma japonicum*.

Our present knowledge of molluscan host specificity is very fragmentary. The final answer will probably come from a physiological analysis of each implicated molluscan species. Miracidia of the trematode must not only be attracted to the snail, but upon entering must develop successfully to the cercarial stages. The miracidia of *Schistosoma japonicum* in the Philippines are not in the least attracted to thiarid or lymnaeid snails, but they do make rapid advances toward *Oncomelania quadrasi* and several species of *Syncera*. *O. quadrasi* is the only known intermediate host of this trematode in that area, but several hundred specimens of *Syncera* examined from the endemic region of Palo, Leyte, showed no signs of infection, nor was an attempt to infect three species of "attractive" *Syncera* successful. Chinese species of *Syncera* collected from the same spot as infected *Oncomelania nosophora* always gave negative results. That miracidia are attracted to *Syncera* is perhaps correlated with the fact that this snail has very much the same amphibious habits as *Oncomelania*. The same commensal ciliates are found abundantly in the mantle cavity of these two genera but are absent from snails that have no attraction for *japonicum* miracidia.



An amphibious nature appears to be a prime requisite of a snail in order to serve successfully as an intermediate host to *Schistosoma japonicum*. The reason for this is still little understood. Whether the nature of the environment, such as periodic fluctuation in the temperature of the snail due to resubmergence in rising and ebbing waters, or a host of other conditions brought about by the external environment, or whether the nature of the physiological environment of the snail itself (conditioned in turn by the external habitat) is what makes this type of snail a suitable host is as yet unknown.

A few scanty observations have been made that aid in defining the habitudinal limits of a schistosome-carrying snail. In the family Amnicolidae there are various genera whose species possess characters that appear to be correlated with a general evolutionary trend toward more and more terrestrial habits. These characters are the number of gills, degree of development of the pedal mucus gland, and the production of mucus. Other characters take a special course in modifications, but their correlation with the trend toward amphibious life is probably accidental.

<i>Genus</i>	<i>Habitat</i>	<i>Number of gills</i>	<i>Pedal gland</i>
<i>Bulimus</i> -----	Completely aquatic-----	150-100	Slightly developed.
<i>Oncomelania</i> ---	Moderately amphibious:	50	Moderately developed.
<i>Pomatiopsis</i> ----	Distinctly amphibious---	27-28	Well developed.
(Synceeridae----	Amphibious to terrestrial	0	Enormously developed.)

*Zoogeography*.—The distribution of *Pomatiopsis lapidaria* (Say), as indicated on the map (fig. 10), extends throughout the Mississippi River drainage system, into southern Canada, and across into the central portion of the Atlantic Seaboard. The distribution of the lung-fluke disease, *Paragonimus kellicotti* Ward, can be superimposed directly on that of the snail except for the Atlantic seaboard area. The second intermediate crayfish hosts, some ten species of the closely related genera *Cambarus*, *Procambarus*, and *Oroconectes*, have a much wider range than either the first intermediate snail host or the parasitic trematode, and although they are necessary members of the host cycle they do not delimit the distribution of the disease as does the snail.

The origins of the various species of *Pomatiopsis* in North America have not yet been speculated upon, although the close morphological similarity of *P. lapidaria* (Say) and *Oncomelania nosophora* (Robson) suggests that their common ancestor's range extended across the old Bering Sea connection. Some hope may be held for a fairly complete picture of the systematic relationships of the various species of American *Pomatiopsis*, but this will have to come through cytological observation of chromosomal differences, similar to that of Dobzhansky and others with insects. The divergence in external morphology



shown by related forms is not necessarily proportional to the extent of chromosome reconstruction, so that a true picture cannot be obtained from anatomical observations alone.

### CATALOG OF AMERICAN POMATIOPSIS

- Pomatiopsis binneyi* TRYON, Proc. Acad. Nat. Sci. Philadelphia, 1863, p. 148, pl. 1, fig. 10 (Bolinás, Calif.).
- Pomatiopsis californica* PILSBRY, Nautilus, vol. 12, No. 11, p. 126, 1899 (San Francisco and Oakland, Calif.).
- Pomatiopsis chacci* PILSBRY, Nautilus, vol. 50, No. 3, p. 84, 1937 (from a swampy place 6 miles up the highway from Klamath, Humboldt County, Calif.).
- Pomatiopsis cincinnatiensis* (LEA), Proc. Amer. Philos. Soc., vol. 1, p. 289, 1840 (vicinity of Cincinnati, Ohio). (*Cyclostoma*.)
- Pomatiopsis hinkleyi* PILSBRY, Nautilus, vol. 10, No. 4, p. 37, 1896 (Black Falls, above Florence, Ala.).
- Pomatiopsis lapidaria* (SAY), Journ. Acad. Nat. Sci. Philadelphia, vol. 1, p. 13, 1817 (no locality). (*Cyclostoma*.)
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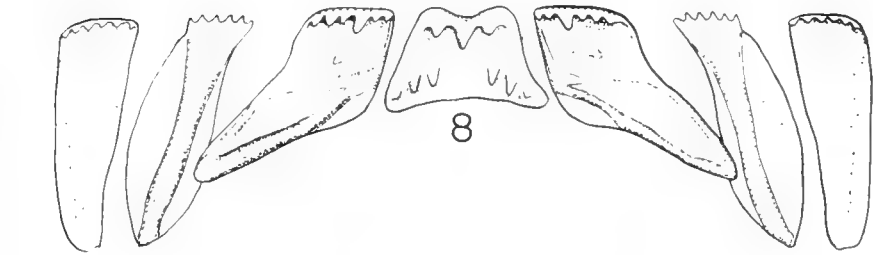
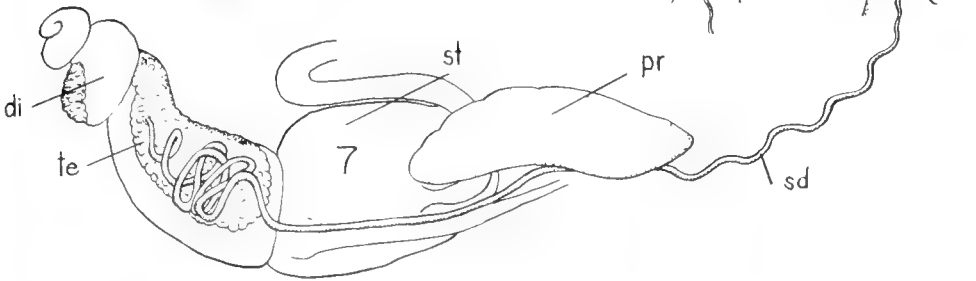
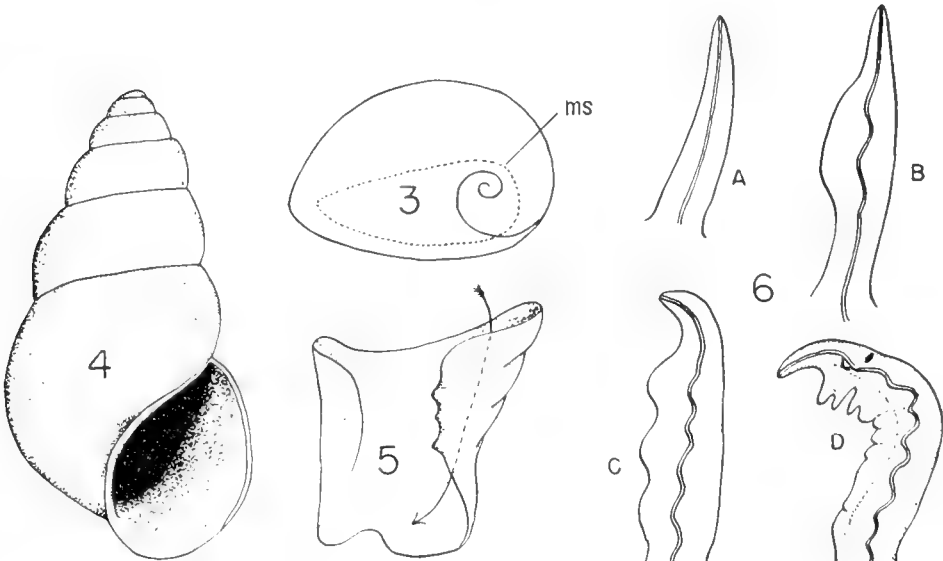
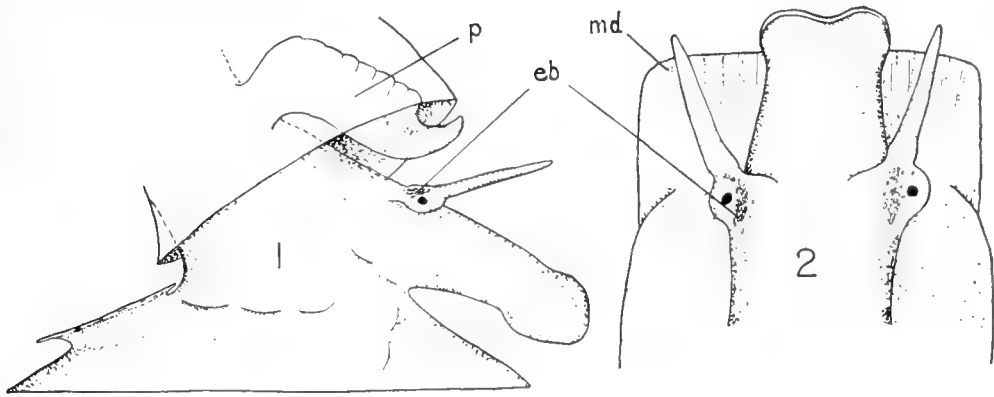
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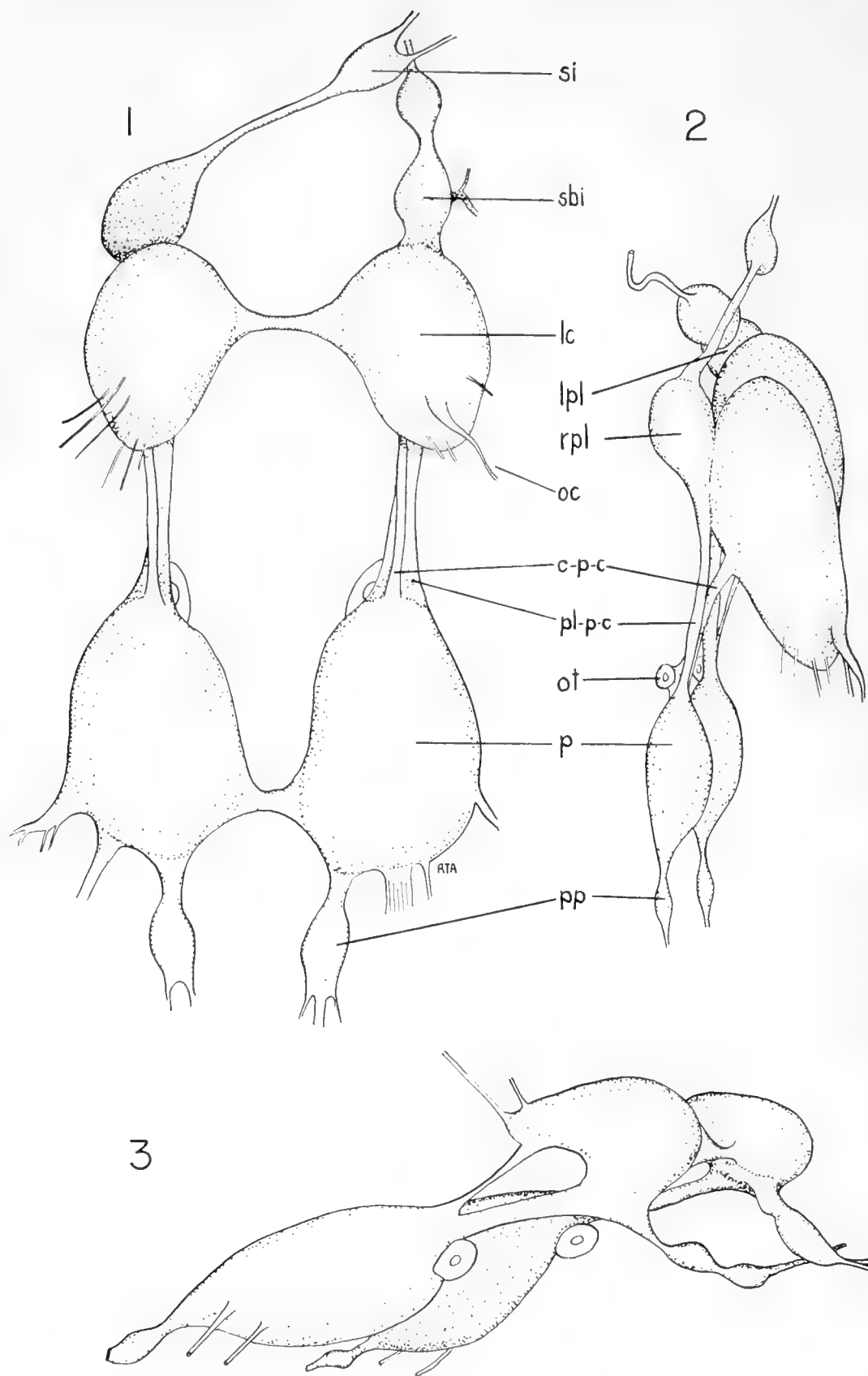
PLATE 3

*Pomatiopsis lapidaria* (Say)

1. Side view of animal,  $\times 9$ . (*p*=penis or verge; *eb*=yellow dermal chromatophores, or "eyebrows.")
2. Dorsal view of animal,  $\times 10$ . (*md*=mucus ducts of pedal gland.)
3. Operculum,  $\times 10$ . (*ms*=scar of muscle attachment.)
4. Shell,  $\times 12$ .
5. Gastric sheath,  $\times 25$ . Arrow indicates path of food through stomach.
6. *a*, Penis of immature male; *b-d*, variations in penis of mature males.  $\times 12$ .
7. Gross anatomy of male reproductive system,  $\times 12$ . (*di*=digestive gland; *pr*=prostate gland; *sd*, sperm duct; *st*, stomach; *te*, testes.)
8. Dorsal view of one row of the radula (slightly spread).
9. End view of radula (slightly spread).



POMATIOPSIS LAPIDARIA (SAY)  
SEE OPPOSITE PAGE FOR EXPLANATION.



1. Dorsal view of central nervous system of *Oncomelania hupensis* Gredler,  $\times 30$ .
  2. Right side view of central nervous system of *Pomatiopsis lapidaria* Say,  $\times 25$ .
  3. Three-quarters view of central nervous system of *Oncomelania hupensis* Gredler,  $\times 25$ .
- [c-p-c=cerebro-pedal connective; lc=cerebral ganglion; lpl=left pleural ganglion; oc=ocular nerve; ot=otocyst; p=pedal ganglion; pl-p-c=pleural pedal connective; pp=parapodial ganglion; sbi=subintestinal ganglion; si=supra-intestinal ganglion.]

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## STATUS OF THE PYRAUSTID MOTHS OF THE GENUS LEUCINODES IN THE NEW WORLD, WITH DESCRIPTIONS OF NEW GENERA AND SPECIES

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By HAHN W. CAPPS

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A PYRAUSTID species, listed in the literature as *Leucinodes elegantalis* Guenée, has recently attracted considerable attention as a pest of tomatoes in South America, particularly in the states of Paraná and Minas Gerais, Brazil, where severe damage to crops has been reported. In addition to actual damage due to the larvae, further losses have been incurred by the application of regulatory measures by some countries restricting the movement of shipments from areas where the insect is known to occur.

In 1942 adults of *Leucinodes elegantalis* Guenée were reared by inspectors of the Division of Foreign Plant Quarantines, Bureau of Entomology and Plant Quarantine, United States Department of Agriculture, from larvae intercepted at Laredo, Tex., in shipments of tomatoes from Tampico, Tamaulipas, Mexico.

Critical examination of the *Leucinodes* material in the collection of the United States National Museum revealed that the series were mixed, often containing several species, and that the characters heretofore used for recognizing the species, such as the relative lengths of second and third segments of labial palpus or slight differences in maculation, were inadequate. This study was undertaken to furnish reliable characters by which *elegantalis* could be separated from the species closely related to it, and also to determine definitely the extent of its distribution.

There has been some confusion in the literature regarding the type of the genus *Leucinodes* Guenée. Hampson, applying his first-species rule, cited *Leucinodes elegantalis* Guenée as its type in his Fauna of British India (Moths) (vol. 4, p. 370, 1896). The citation was repeated in his treatment of the subfamily Pyraustinae in the Proceedings of the Zoological Society of London (1898, p. 756) and was followed by A. Klima in the Junk Lepidopterorum Catalogus (pt. 94, p. 302, 1939). According to the International Rules of Zoological Nomenclature, its use is made invalid by the prior citation of *Leucinodes orbonalis* Guenée as the type by Walker in his Catalogue of Lepidopterous Insects in the British Museum (vol. 17, p. 392, 1859). Therefore, the valid type of *Leucinodes* Guenée is *orbonalis* and not *elegantalis*.

*Leucinodes orbonalis* is an Old World (Ethiopian and Oriental regions) species and was described from one male ("Inde centrale") and one female (Java). In Ceylon and India it has been reported as a pest of *Solanum melongena* L. (eggplant). It occurs also in South Africa, Burma, Sumatra, China, and the Philippine Islands, but so far as is known it is not established in the New World.

This change of type for the genus requires the reassignment of our American species heretofore placed in *Leucinodes*, since none of them are congeneric with *orbonalis*, which has the frons with a strong conical production; forewing with vein 10 separate from veins 8, 9; uncus with distal spines dorsal; harpe with two strong hooks, one originating from near base of costa, and the other from near middle of lower margin; anellus narrow, acuminate, with two short, oblique, median projections. The American species differ from *orbonalis* in type of frons, venation, genitalia, or a combination of them.

Material other than that at the United States National Museum was made available for study from the collections of Cornell University by W. T. M. Forbes; American Museum of Natural History by C. D. Michener; and Transvaal Museum, Pretoria, South Africa, by A. J. T. Janse.

It is apparent from the material at hand that a natural grouping of the Old World species will require the removal of some from *Leucinodes*. However, since a number of them are not represented in the available material, and their types inaccessible at this time, this treatment is confined to those species occurring in the New World. None of the species occurs in both the Old and the New World. All the American species, except one, are represented in the collection of the United States National Museum.

Since venation is much the same throughout the entire subfamily, with only a few exceptions, and the third segment of the labial palpus different for the sexes, to secure a natural grouping of the species in



the Pyraustinae will require the extensive use of genitalic characters. To avoid needless repetition in generic diagnoses, characters common to those treated here are as follows: Antenna simple, slightly annulate. Maxillary palpus minute. Labial palpus upturned, first segment rather heavily scaled below, fringelike, the scales projected distally; second segment moderately scaled below and with a similar projection; third segment porrect, without such fringe or projection. Forewing (pl. 6, figs. 7, 8) with vein 1a running into vein 1b near middle (often difficult to distinguish except in denuded or cleared material); vein 3 from slightly before angle of cell; veins 4 and 5 separate; vein 7 from cell, slightly curved and approximate to vein 8, 9 for about one-sixth its length; veins 8 and 9 stalked. Hind wing (pl. 6, fig. 7A) with cell long, extending to about middle of wing; vein 3 from slightly before angle of cell; veins 4 and 5 separate; vein 6 from upper angle of cell, often anastomosed with 7 for a short distance; vein 7 anastomosing with vein 8 for some distance beyond the cell. Hind tibia with two pairs of subequal spurs.

## KEY TO THE GENERA TREATED

1. Forewing with vein 10 distinctly out of stalk of veins 8 and 9 (pl. 6, fig. 7).  
Neoleucinodes, new genus  
 Forewing with vein 10 from the cell (in occasional specimens contiguous or partially anastomosed with stalk of veins 8 and 9) (pl. 6, fig. 8) ----- 2
2. Frons with conical production conspicuous ----- 3  
Proleucinodes, new genus  
 Frons evenly rounded or only slightly produced; not conically as above.
3. Male genitalia with harpe simple, unarmed ----- Euleucinodes, new genus  
 Male genitalia armed with clasper ----- Leucinodes Guenée

## Genus LEUCINODES Guenée

*Leucinodes* GUENÉE, Histoire naturelle des insectes lépidoptères, deltoids et pyralites, p. 221, 1854.—WALKER, List of the lepidopterous insects in the collection of the British Museum, vol. 17, p. 392, 1859.—LEDERER, Wein. Ent. Monatschr., vol. 7, p. 440, 1863.—MOORE, Lepidoptera of Ceylon, vol. 3, p. 288, 1883.—HAMPSON, Fauna of British India (Moths), vol. 4, p. 370, 1896; Proc. Zool Soc. London, 1898, pp. 598, 755.—SHIBUYA, Journ. Fac. Agr. Hokkaido Imp. Univ. Sapporo, vol. 22, pp. 172, 244, 1898.—KLIMA, in Junk, Lepidopterorum catalogus, pt. 94, p. 302, 1939. (Type: *Leucinodes orbonalis* Guenée, designation by Walker, 1859.)

*Remarks.*—Old World species (Ethiopian and Oriental regions).

## NEOLEUCINODES, new genus

*Type.*—*Leucinodes elegantalis* Guenée.

With characters noted for the group and in addition: Frons evenly rounded. Forewing with vein 10 distinctly out of stalk of veins 8 and 9 (pl. 6, fig. 7). Male genitalia (pl. 6, fig. 9) with spines of uncus dorsal; gnathos absent; harpe with clasper. Female genitalia (pl. 9, fig. 17) without signum; ductus bursa long and slender.

*Remarks.*—Easily distinguished from *Leucinodes* Guenée by absence of conical frons and forewing with vein 10 from stalk of veins 8 and 9 (such venation abnormal for the subfamily, vein 10 normally from cell). A New World genus, tropical or subtropical in distribution.

#### KEY TO SPECIES OF NEOLEUCINODES

##### Males

1. Harpe armed with a single clasper (pl. 6, fig. 9)----- 2  
     Harpe armed with a clasper and an ampullalike attenuate process (pl. 7, fig. 13)-----5. *imperialis* (Guenée)
2. Harpe with clasper postmedial, nearer to apex than to base (pl. 7, figs. 11, 12)----- 4  
     Harpe with clasper medial or antemedial (as near or nearer to base of harpe than to apex) (pl. 6, figs. 9, 10)----- 3
3. Aedeagus with cornutus axlike in shape (pl. 6, fig. 10a)---2. *dissolvens* (Dyar)  
     Aedeagus with cornutus a simple, straight spine-----1. *elegantalis* (Guenée)
4. Aedeagus stout, cornutus a long, slender, curved spine, somewhat expanded basally (pl. 7, fig. 11A)-----3. *prophetica* (Dyar)  
     Aedeagus slender, armature a short stout hook and a narrow concave sclerotization (pl. 7, fig. 12A)-----4. *torvis*, new species

##### Females

1. Bursa copulatrix with a narrow saclike appendage (pl. 10, figs. 20, 21)----- 2  
     Bursa copulatrix simple, without such appendage (pl. 9, figs. 17-19)----- 3
2. Sclerotization along ventral margin of genital opening continuous, with a median fold (pl. 10, fig. 20)-----4. *torvis*, new species  
     Sclerotization of genital opening discontinuous ventrally, the sclerotization restricted to the sides (pl. 10, fig. 21)-----5. *imperialis* (Guenée)
3. Ventral margin of genital opening with sclerotization strong, a narrow continuous band, and with a membranous pouchlike invagination (pl. 9, fig. 19).  
     3. *prophetica* (Dyar)  
     Ventral margin of genital opening membranous, or only slightly sclerotized; without such invagination (pl. 9, figs. 17, 18)----- 4
4. Ductus bursa narrow; expansion of bursa copulatrix anteriorly from junction with ductus bursa evident (pl. 9, fig. 17)-----1. *elegantalis* (Guenée)  
     Ductus bursa wider; expansion of bursa copulatrix anteriorly from junction with ductus bursa gradual, junction hardly discernible (pl. 9, fig. 18).  
     2. *dissolvens* (Dyar)

#### 1. NEOLEUCINODES ELEGANTALIS (Guenée)

##### PLATE 5; PLATE 6, FIGURES 7, 7a, 9, 9a; PLATE 9, FIGURE 17

*Leucinodes elegantalis* GUENÉE, Histoire naturelle des insectes lépidoptères, deltoïds et pyralites, p. 222, pl. 3, fig. 8, 1854.—HAMPSON, Proc. Zool. Soc. London, 1898, p. 756.—DYAR, Proc. U. S. Nat. Mus., vol. 47, p. 278, 1914.—TORRES, Bol. Minist. Agr. Inc. e Comm. (Rio de Janeiro), vol. 12, No. 2, pp. 38-46, 1923.—HAMBELTON, Insect Pest Survey Bull., U. S. Dept. Agr., vol. 12, No. 7, p. 342, 1932; Insect Pest Survey Bull., U. S. Dept. Agr., vol. 13, No. 2, p. 63, 1933.—BALLOU, Insect Pest Survey Bull., U. S. Dept. Agr., vol. 13,

No. 9, p. 222, 1933.—MONTE, Bol. Agr. Zootecn. Vet. Minas Geraes (Belo Horizonte), vol. 6, No. 6, pp. 357-359, 1933.—PINTO DA FONSECA, Arch. Inst. Biol., vol. 5 (São Paulo), pp. 263-289, 1934.—WOLCOTT, Journ. Agr., Univ. Puerto Rico, vol. 20, No. 1, p. 463, 1936.—KLIMA, in Junk, Lepidopterorum catalogus, pt. 94, p. 304, 1939.—SCHAUS, Scientific survey of Porto Rico and the Virgin Islands, New York Acad. Sci., vol. 12, pt. 3, p. 360, 1940.—LE PAGE, Biológico, vol. 10, No. 2, pp. 42-46, 1944; Rev. Applied Ent., vol. 33, ser. A, pt. 3, p. 94, 1945.

*Adult*.—Male (pl. 5, fig. 1): Antenna simple, slightly annulate, length of cilia approximately equal to thickness of shaft near base. Labial palpus upturned, cinnamon-brown, occasionally with a few scattered dark fuscous scales; second and third segments scaled below, the first segment rather heavily (fringelike), with scales projected distally; second segment moderately scaled with similar distal projection; third segment porrect, without such scaling below or distal projection; length of third segment one-half or less than one-half that of second segment. Frons evenly rounded, cinnamon brown intermingled with some dark fuscous and occasionally a few white scales. Posterodorsal area of head and also that between the antennae often with the white scales predominant.

Thorax (dorsal view) a mixture of brown, dark fuscous, and white scales, with the white often more abundant on the prothorax and appearing as a white patch; thorax (ventral view) white.

Abdomen (dorsal view) with a conspicuous white band composed of all the first and variable portions of second and third segments, remainder of segments a mixture of cinnamon brown and dark fuscous scales; abdomen (ventral view) with all the first and a greater portion than dorsally of the second and third segments white; other segments paler than on dorsum. Small concolorous lateral tufts present but often difficult to distinguish (lost on worn specimens).

Wings white, somewhat hyaline, with conspicuous squamous areas of cinnamon brown and dark or blackish fuscous as figured. Anterior transverse line of forewing distinctly concave. In flown specimens some of the markings are almost lost (particularly the patch from costa between the transverse anterior line and the reniform), the areas being only faintly indicated by the narrow border of dark fuscous scales.

Alar expanse, 15-33 mm.

Genitalia with harpe slender, elongate, and apex much narrower than base; clasper slender, scalpel-like, and in relation to lower margin of harpe the clasper from near middle or distinctly nearer to base than to apex (pl. 6, fig. 9). Aedeagus (pl. 6, fig. 9A) slender; cornutus a simple spine, not conspicuously expanded at base.

Female: Antenna simple, slightly annulate, length of cilia slightly less than width of shaft near base. Labial palpus as in male except

with third segment longer, its length approximately equal that of second segment. Similar otherwise to male in color and maculation.

Alar expanse, 15–30 mm.

Genitalia (pl. 9, fig. 17) with genital opening broad; ductus bursa long, slender, with a narrow sclerotized collarlike structure slightly anterior to origin of ductus seminalis; membranous or only slightly sclerotized between the collar and genital opening, the sclerotization, if present, stronger anteriorly; bursa copulatrix simple, expansion from junction with ductus bursa evident.

*Larva*.—Arrangement of body setae is that of typical pyraustid (pl. 5, fig. 6). Prothorax with two setae on the prespiracular shield; group VI bisetose. Meso- and metathorax with group VI unisetose. Abdominal segments 3–6 with seta IV approximate to seta V, under the spiracle. Ninth abdominal segment with paired setae II on same pinaculum; seta I approximate to seta III and on same pinaculum; setae IV and V absent, only seta VI of this group present. Crochets on abdominal prolegs irregular or triordinal in length; often arranged in a complete circle but usually weaker or interrupted outwardly (at least on some of the prolegs).

Mature larva 15–20 mm. long, robust, and conspicuously tapered posteriorly (ninth abdominal and anal segments greatly reduced in size). Body color white or pinkish. Body setae without conspicuous sclerotized, pigmented pinacula at their bases, the pinacula usually concolorous with adjacent body area and slightly raised (blisterlike), particularly on meso- and metathorax. Prothoracic shield pale yellow, markings light brown, without a conspicuous blackish reniform spot posterior to seta Ib. No anal fork. Head a little wider than high; pale yellow, reticulation indistinct (pl. 5, fig. 2); lateral view (pl. 5, fig. 3), slightly rounded and not appreciably flattened; with a short, rather broad dark fuscous pigmentation along incision from hind margin; ocellus II much closer to ocellus I than to ocellus III; a dark fuscous pigmentation along ocellar arc, the intensity of the pigmentation distinctly weaker in area between ocelli II and III; seta  $O_1$  tangent to or anterior to a line joining centers of ocelli II and III. Mandible with lower ventral rib of oral surface smooth, except for a minute toothlike projection from near base of lower tooth.

This combination of characters will serve to distinguish the larvae of *elegantalis* from all other American larvae known to me that are associated with eggplant or tomato. The pale, concolorous, or only slightly pigmented body pinacula of *elegantalis* larvae will distinguish them from those of *orbonalis*, which have the pinacula rather strongly sclerotized and a distinct ochereous or brownish pigmentation. Larvae of *elegantalis* also have seta  $O_1$  tangent to or anterior to a line connecting centers of ocelli II and III while those of *orbonalis* have seta  $O_1$  distinctly posterior to such line.

*Pupa*.—Color light to dark brown; 12–15 mm. long. Typical pyraustid (pl. 5, fig. 5), with cremaster; dorsum of abdominal segments smooth and without spinelike armature; a prominent hoodlike protuberance above the spiracle on abdominal segments 2 and 3 (pl. 5, fig. 4). Pupation is above ground, the pupa enclosed in a fragile cocoon attached to dried leaves or other debris.

*Type*.—Originally in the Guenée collection; present location unknown.

*Type locality*.—Brazil.

*Food plants*.—*Cyphomandra betacea* Sendt., *Lycopersicum esculentum* Mill. (tomato), *Solanum melongena* L. (eggplant), and *Solanum sisymbriifolium* Lam.

*Distribution*.—CUBA: Baracoa and Santiago (January). PUERTO RICO: Bayamon and Guayama (March, April). JAMAICA (no date). GRENADA (no date). TRINIDAD (no date). MEXICO: Jalapa, Córdoba, Orizaba, and Tampico in Veracruz; Mante, Tamaulipas; Chapala, Jalisco; Caleras, Colima; Rosario, Sinaloa (October, December, January, February). GUATEMALA: Purulha, Volcán Santa María (no dates). COSTA RICA: San José, Río Segundo, and Saxiola River (March, November). PANAMA: Barro Colorado Island, Cabima, Paraiso, Río Trinidad, Taboga Island (February, March, May, June). PERU: Hullaga (no date). ECUADOR: Loja (March). COLOMBIA: San Antonio (November). VENEZUELA: Aroa San Estaban, Carabobo, Los Tigres (October, December). BRITISH GUIANA: Tumatumari, Potara River (June). FRENCH GUIANA: St. Jean Maroni (no date). BRAZIL: Castro Paraná, Minas Gerais (October). PARAGUAY: Villarica (March, September). ARGENTINA: Concordia, Entre Ríos (July).

Number of specimens examined, 109.

*Remarks*.—The damage to crops where *elegantalis* occurs ranges from unnoted in such places as Cuba and Puerto Rico, negligible in Mexico (Tamaulipas, 1945–46 season), to as high as 30 or 80 percent in Paraná and Minas Gerais, Brazil. No satisfactory methods have been reported for the control of *elegantalis* where environmental conditions are optimum for its building up and maintaining large populations. The effective application of control is complicated by its larval habits. The larvae are strictly borers, feeding only in the fruits. Soon after hatching, the young larva bores into the young fruit and as the fruit develops the entrance hole is closed. Thus a fruit that looks perfectly normal, even under a hand lens, may contain one or several larvae. It is only when the larva is mature or about mature and has the exit hole complete or nearly complete that there are signs to indicate its presence inside the fruit. The number of larvae per fruit is usually one, two, or three, but as many as 18 have been found in a single fruit.

Further investigations, no doubt, will reveal some parasites which attack it and also additional food plants.

### 2. NEOLEUCINODES DISSOLVENS (Dyar)

PLATE 6, FIGURES 10, 10a; PLATE 9, FIGURE 18

*Leucinodes dissolvens* DYAR, Proc. U. S. Nat. Mus., vol. 47, p. 278, 1914.—KLIMA, in Junk, Lepidopterorum catalogus, pt. 94, p. 304, 1939.

*Male*.—Closely resembles *elegantalis* but separable from it by the transverse anterior line of forewing; for *elegantalis* the line is strongly concave (pl. 5, fig. 1) while for *dissolvens* it is straight and outwardly oblique from costa to vein 1b where it is angled inwardly to hind margin of wing (angled portion often indistinct in flown specimens).

Alar expanse, 14–22 mm.

Genitalia similar to those of *elegantalis* but averaging smaller in size and with the harpe relatively stouter (pl. 6, fig. 10), and the cornutus expanded basally, somewhat axlike in shape (pl. 6, fig. 10a).

*Female*.—Similar to male in color and maculation.

Alar expanse, 20–25 mm.

Genitalia (pl. 10, fig. 18) very much like those of *elegantalis* but with expansion of ductus bursa gradual anteriorly, its juncture with the bursa copulatrix indefinite.

*Type*.—U.S.N.M. No. 16159.

*Type locality*.—St. Jean Maroni River, French Guiana.

*Food plants*.—Unknown.

*Immature stages*.—Unknown.

*Distribution*.—ECUADOR: Loja. FRENCH GUIANA: Cayenne, St. Jean Maroni, and St. Laurent du Maroni. DUTCH GUIANA (SURINAM): Moengo Boven, Cottica River (May). BRAZIL: São Paulo do Olovença Amazonas (November, December).

Fifteen specimens examined.

*Remarks*.—Dissection of the genitalia shows that the specimen from Aroa, Venezuela (Schaus collection), noted by Dyar when he described the species, is *prophetica* and not *dissolvens*.

### 3. NEOLEUCINODES PROPHETICA (Dyar), new status

PLATE 7, FIGURE 11, 11a; PLATE 9, FIGURE 19

*Leucinodes elegantalis* var. *prophetica* DYAR, Proc. U. S. Nat. Mus., vol. 47, p. 278, 1914.—KLIMA, in Junk, Lepidopterorum catalogus, pt. 94, p. 304, 1939.

*Male*.—Maculation similar to that of *dissolvens* but with the oblique transverse anterior line of forewing somewhat slenderer and cilia of antenna a little longer than those of *dissolvens*.

Alar expanse, 14–16 mm.

Genitalia similar to those of *dissolvens* but with clasper closer to apex than base of harpe (pl. 7, fig. 11); cornutus distinctly curved and narrowly, somewhat irregularly expanded at base (pl. 7, fig. 11a).



*Female*.—Similar to male in color and maculation.

Alar expanse, 15–21 mm.

Genitalia (pl. 9, fig. 19) with sclerotization of ventral margin of genital opening continuous; with a pouchlike membranous invagination.

*Type*.—U.S.N.M. No. 16158.

*Type locality*.—Río Trinidad, Panama.

*Food plant*.—Unknown.

*Immature stages*.—Unknown.

*Distribution*.—PUERTO RICO: Adjuntas (June). GUATEMALA: Cacyuga (April), Tequisatl (April, May). COSTA RICA: Avangarez, Carillo, Sixaola River (July, September). PANAMA: Río Trinidad (March, June), Barro Colorado, Canal Zone (February). PERU: Tinguiri, Carabaya. VENEZUELA: Aroa. BRAZIL: Rio de Janeiro (June).

Nineteen specimens examined.

*Remarks*.—Easily confused with *dissolvens* and some small specimens of *elegantalis*, but a good species and not a variety of *elegantalis*, there being no difficulty in separation by means of genitalia.

#### 4. NEOLEUCINODES TORVIS, new species

#### PLATE 7, FIGURES 12, 12a; PLATE 10, FIGURE 20

*Male*.—Antenna simple, slightly annulate, with the cilia very short (pubescentlike), length much less than width of shaft. Palpus, head, thorax, and abdomen whitish or pale ochereous, with some white and light fuscous scales intermingled. Abdomen without conspicuous white band anteriorly. Wings sordid white with maculation similar to that of *elegantalis* but with the markings more obscure and the medial patch on hind margin of forewing narrower, not conspicuously broadened posteriorly. Transverse anterior line of forewing slightly oblique, thin and indistinct; often not discernible on worn specimens.

Alar expanse, 11–15 mm.

Genitalia similar to those of *elegantalis* but with the harpe broader distally and the clasper near to apex than base of harpe (pl. 7, fig. 12); armature of aedeagus a small, narrow, concave sclerotization and a short, stout, hooklike process (pl. 7, fig. 12a).

*Female*.—Similar to male in color and maculation. Antenna slightly slenderer than that of male.

Alar expanse, 12–18 mm.

Genitalia (pl. 10, fig. 20) with sclerotization along ventral margin of genital opening continuous, with a median fold or crease; bursa copulatrix with a slender saclike extension.

*Type*.—U.S.N.M. No. 58278.

*Type locality*.—Santiago, Cuba.



*Food plant.*—*Solanum torvum* Sw.

*Immature stages.*—No specimens or data other than food-plant record available.

*Distribution.*—CUBA: Baracoa, Santiago de las Vegas, Habana (June, November). PUERTO RICO: Coama Springs (April), Bayamon (May), San Germán (September), Lares (August), Río Piedras (August), and Utado. JAMAICA, GRENADA (June), DOMINICA (June), VIRGIN ISLANDS, ST. CROIX (October, November). MEXICO: Córdoba, Veracruz (April), La Gloria Cordel, Veracruz (January). GUATEMALA: Cayuga, Quirigua (November). COSTA RICA: Carillo (March). PANAMA: Corozal (November), Carro Saddle (May), Paraiso (February), Porto Bello (April, May, November), Río Trinidad (March), Taboga Island (March), and Tabernilla. PERU: Bonita, Pura (?) (July). BRAZIL: Viscosa, Minas Gerais (October). BRITISH GUIANA: Bartica (June), Mackenzie, Demarara River (June). DUTCH GUIANA: Moengo Boven, Cottica River (May). FRENCH GUIANA: St. Jean Maroni.

Number of specimens examined, 139.

*Remarks.*—Well-marked specimens resemble small examples of *elegantalis*, *dissolvens*, and *prophetica* but are easily separated from them by the very short pubescentlike cilia of antenna. Rubbed specimens also easily confused with *imperialis*, the species that follows, which has similar antenna but which has a distinct white anterior abdominal band not possessed by *torvis*.

Paratypes in collections of the American Museum of Natural History, Cornell University, Transvaal Museum (Pretoria, South Africa), and British Museum.

##### 5. NEOLEUCINODES IMPERIALIS (Guenée)

PLATE 7, FIGURES 13, 13a; PLATE 10, FIGURE 21

*Leucinodes imperialis* GUENÉE, Histoire naturelle des insectes lépidoptères, deltoïdes et pyralites, p. 223, 1854.—HAMPSON, Proc. Zool. Soc. London, 1898, p. 756.—KLIMA, in Junk, Lepidopterorum catalogus, pt. 94, p. 304, 1939.

*Leucinodes* (?) *discerptalis* WALKER, List of lepidopterous insects in the collection of the British Museum, vol. 34, p. 1313, 1865.—KLIMA, in Junk, Lepidopterorum catalogus, pt. 94, p. 304, 1939.

*Leucinodes discerptalis* Walker, HAMPSON, Proc. Zool. Soc. London, 1898, p. 756.

*Male.*—Strongly marked specimens resembling small specimens of *elegantalis* but with the wings more immaculate and the rather large brown, medial patch from hind margin of forewing absent or hardly discernible. Transverse anterior line of forewing brown, rather than blackish fuscous. Abdomen, thorax, and brownish markings of wings paler than *elegantalis*, with little if any intermingling of dark

fuscous scales. Abdomen with a whitish anterior band. Antenna with cilia very short (pubescentlike); length much less than width of shaft.

Alar expanse, 16–18 mm.

Genitalia (pl. 7, fig. 13) with the harpe rather short; clasper short and slender, near lower margin and about one-fifth length of harpe from apex; a rather stout attenuate sclerotized process originating from costa of harpe. Aedeagus with two opposed attenuate processes (pl. 7, fig. 13a).

*Female*.—Similar to male in color and maculation.

Alar expanse, 14–20 mm.

Genitalia (pl. 10, fig. 21) resemble those of *torvis* but stouter; genital opening with sclerotization along lateral margins, the sclerotization interrupted ventrally. Bursa copulatrix with a saclike extension.

*Types*.—Originally in Guenée collection; present location unknown (*imperialis*). In British Museum (*discerptalis*).

*Type localities*.—Haiti (*imperialis*); Limas, Honduras (*discerptalis*).

*Food plant*.—Unknown.

*Immature stages*.—Unknown.

*Distribution*.—COSTA RICA: Carillo (March), Juan Vinas (June), Tuis (May, September). PANAMA: Cabima (August), La Chorrera (May); Porto Bello (May), Tabernilla (no date), Río Trinidad (March, June). BRAZIL: Paraná (no date), Viscosa, Minas Gerais (October), Rio de Janeiro (no date).

Number of specimens examined, 33.

*Remarks*.—Sometimes confused with worn specimens of *elegantalis*, *dissolvens*, *prophetica*, and *torvis*. The very short (pubescentlike) cilia of the antenna will separate it from all these but the latter, from which it may be distinguished by the whitish anterior abdominal band.

#### PROLEUCINODES, new genus

*Type*.—*Leucinodes melanoleuca* Hampson.

With characters common to the group and in addition: Frons evenly rounded, or if produced, only moderately so, not strongly conical. Forewing with vein 10 from cell, closely approximate to, contiguous, or partially anastomosed with stalk of veins 8 and 9. Male genitalia (pl. 8, fig. 15) with spines of uncus ventral; gnathos absent; harpe without clasper.

*Remarks*.—Members of this genus readily separated from those of *Neoleucinodes* by vein 10 of forewing, and from *Leucinodes* by the simple unarmed harpe.

## KEY TO SPECIES OF PROLEUCINODES

*Males*

1. Anellus slightly constricted near middle; distal half crinkled, deeply incised medially (pl. 8, fig. 15). Aedeagus expanded distally, cornutus a strong, curved hook (pl. 8, fig. 15a) ----- 6. *melanoleuca* (Hampson)  
 Anellus narrowly constricted near middle, without such median incision (broadly concave distally) (pl. 8, fig. 16). Aedeagus narrowed distally, cornutus absent (pl. 8, fig. 16a) ----- 7. *xylopastalis* (Schaus)

## 1. PROLEUCINODES MELANOLEUCA (Hampson)

## PLATE 8, FIGURES 15, 15a

*Leucinodes melanoleuca* HAMPSON, Ann. Mag. Nat. Hist., ser. 8, vol. 11, p. 323, 1913.—KLIMA, in Junk, Lepidopterorum catalogus pt. 94, p. 304, 1939.

*Male*.—Resembles large specimens of *elegantalis* but with the wings a little broader, apex of forewing less produced and excavation of margin between apex and vein 4 shallower. Dorsum of head and thorax white, irrorated with a few fuscous scales. Palpus dorsally and laterally brownish fuscous; ventrally near base whitish irrorated with brown and fuscous. Frons white and fuscous, the fuscous predominant. Abdomen with a white band anteriorly; the white scales overlaid with brown and fuscous posteriorly. Forewing (except marginal areas) more hyaline, without a large conspicuous brownish median patch from hind margin, such area being absent or but faintly indicated by a few scattered brownish-fuscous scales; area bordering excavation whitish with a few dark scales. In *elegantalis* this area a conspicuous cinnamon-brown patch. Discocellulars of hind wing enclosed by a narrow fuscous line forming an irregularly shaped figure 8 instead of a simple, narrow, elongate patch.

Alar expanse, 32–34 mm.

Genitalia (pl. 8, fig. 15) stout; uncus ventrally spined; gnathos absent; harpe simple, without a clasper; vinculum attenuate; anellus broad, slightly constricted, medially incised and with the distal half crinkled. Aedeagus with cornutus a strong hook (pl. 8, fig. 15a).

Three specimens examined.

*Type*.—In British Museum.

*Type locality*.—Cerro de Pasco, Huancabamba, Peru.

*Food plant*.—Unknown.

*Immature stages*.—Unknown.

*Distribution*.—PERU: Huancabamba (6,800 feet alt.).

*Remarks*.—Female unknown.

## 2. PROLEUCINODES XYLOPASTALIS (Schaus)

## PLATE 8, FIGURES 16, 16a

*Leucinodes xylopastalis* SCHAUS, Ann. Mag. Nat. Hist., ser. 8, vol. 9, p. 305, 1912.—KLIMA, in Junk, Lepidopterorum catalogus, pt. 94, p. 304, 1939.

*Male*.—Antenna simple, slightly annulate, length of cilia approximately equal to width of shaft near base. Resembles *melanoleuca* in habitus but with general appearance dull buff instead of white and with maculation less conspicuous, lacking dark fuscous patches of scales. Forewing with outer margin whitish with a narrow border of buff and a slightly darker subparallel subterminal line. Hind wing with outer margin ochereous white with a narrow border of buff and a postmedial line subparallel from costa to about midway between veins 3 and 2 where it is bent sharply inward toward cell to slightly below outer angle of cell and then continuing unevenly to hind margin.

Genitalia somewhat broader than *melanoleuca* (pl. 8, fig. 16); uncus spines ventral; gnathos absent; harpe simple, without clasper; vinculum broad, not conspicuously attenuate; anellus broad basally, without transverse crinkles or median incision; aedeagus simple, without cornutus (pl. 8, fig. 16a).

Four specimens examined.

*Type*.—U. S. N. M. No. 17584.

*Type locality*.—Volcano Turrialba, Costa Rica.

*Food plant*.—Unknown.

*Immature stages*.—Unknown.

*Distribution*.—COSTA RICA: Volcano Turrialba (August). GUATEMALA: Volcano Sta. María (June, July). MEXICO: Chiapas (June).

*Remarks*.—Female unknown.

### 3. PROLEUCINODES LUCEALIS (Felder and Rogenhofer)

#### PLATE 10, FIGURE 22

*Leucinodes lucealis* FELDER and ROGENHOFER, *Reise Novara*, Lepid. Het., p. 13, pl. 135, fig. 3, 1874.—HAMPSON, *Proc. Zool. Soc. London*, 1898, p. 756.—KLIMA, in Junk, *Lepidopterorum catalogus*, pt. 94, p. 304, 1939.

*Female*.—Antenna simple, slightly annulate; cilia very short (pubescentlike), length of cilia much less than width of shaft near base. Palpus scaled with a mixture of white, brown, and a few fuscous scales, the brown predominant dorsally. Abdomen brown with an anterior white band. Similar to *elegantalis* in habitus but with conspicuous differences in maculation, viz: The hyaline area of wings with a slight ochreous tinge. Forewing with brownish area bordering excavation between apex and vein 4 broader near costa, slightly constricted near middle, the border continuous to hind margin; a rather large brown patch adjacent to but separated from it by a narrow white line, the area extending from vein 5 to hind margin with a short, dark fuscous, concave line between it and the median patch on hind margin; a small conspicuous blackish or dark fuscous patch or spots on outer margin in lower half of the excavation. Hind wing with the cinnamon-brown outer band extending from apex to

vein 3, darker and broader, the inner margin of band with a narrow fuscous border; an adjacent short subparallel dark fuscous line extending from costa to vein 5; a small elliptical brown patch with narrow fuscous border on the discocellulars and one or two similiar but irregularly shaped patches on inner margin, one slightly antemedial and the other, if present, near outer angle of wing.

Alar expanse, 22–25 mm.

Genitalia (pl. 10, fig. 22) with margin of genital opening membranous; without a distinct sclerotized collarlike structure near origin of ductus seminalis; bursa copulatrix simple, bulbous; signum absent; ductus bursa short, narrowly constricted.

Six specimens examined.

*Type*.—In Tring Museum.

*Type locality*.—"Amazonas."

*Food plant*.—Unknown.

*Immature stages*.—Unknown.

*Distribution*.—FRENCH GUIANA: St. Laurent du Maroni, St. Jean Maroni. BRAZIL: Rio Iça-Putumayo (August).

*Remarks*.—No male specimens available for examination.

#### EULEUCINODES, new genus

*Type*.—*Euleucinodes conifrons*, new species.

With characters noted for the group and in addition: Frons conically produced. Forewing with vein 10 from cell, not from stalk of veins 8 and 9. Male genitalia with spines of uncus dorsal; gnathos absent; harpe unarmed, without clasper.

*Remarks*.—Easily separated from *Leucinodes* by the unarmed harpe, from *Neoleucinodes* by vein 10 of forewing from cell and the unarmed harpe, and from *Proleucinodes* by the dorsal spining of uncus.

#### EULEUCINODES CONIFRONS, new species

PLATE 6, FIGURE 8; PLATE 8, FIGURES 14, 14a

*Male*.—Antenna simple, slightly annulate; cilia short, length much less than width of shaft near base. Frons strongly produced, conical. Palpus, head, and thorax white irrorated with brown and fuscous. Abdomen with anterior white band; fuscous and brown predominant posteriorly. Wings white with conspicuous brown and fuscous squamous markings. In general appearance resembles large specimens of *elegantalis* but with several notable differences, viz.: Forewing with brownish area bordering excavation between apex and vein 4 less conspicuous, paler and smaller with a considerable intermixture of white scales; brown median patch on hing margin broad, extending to transverse anterior line and toward cell to anal fold,

the patch not conspicuously attenuate anteriorly; transverse anterior line blackish, rather broad and sharply angled outwardly to slightly before middle of vein 2 and then angled sharply inward, reaching hind margin of wing at a point almost directly posterior to point of origin on costa.

Alar expanse, 28 mm.

Genitalia (pl. 8, fig. 14) stout; gnathos absent; uncus with spines dorsal; harpe without clasper; anellus simple, broad, ovate; vinculum broad, not produced. Aedeagus with numerous small scobinations distally and a cluster of short, stout, cornuti (pl. 8, fig. 14a).

*Type*.—In American Museum of Natural History.

*Type locality*.—Río Morona, Peru.

*Food plant*.—Unknown.

*Immature stages*.—Unknown.

*Remarks*.—Described from a single specimen in material loaned by the American Museum of Natural History and labeled: "Rio Morona, Peru 13.I.25, F 6199," "H. Bassler Collection, Acc. 33591." Since this is the only one of the closely related New World genera with a conical frons, there should be no difficulty in recognizing the female when encountered. To date representation of the insect fauna of Peru is very meager in our collections. It is likely that additional species will be added as more material becomes available from this region.

#### SPECIES WITH GENERIC PLACEMENT UNCERTAIN

*Leucinodes impuralis* (Felder and Rogenhofer) HAMPSON, Proc. Zool. Soc. London, 1898, p. 756.—KLIMA, in Junk, Lepidopterorum catalogus, pt. 94, p. 304, 1939.

*Glyphodes* (?) *impuralis* FELDER and ROGENHOFER, Reise Novara, Lepid. Het., p. 10, pl. 135, fig. 2, 1874.

*Type*.—In Tring Museum.

*Type locality*.—Santo Domingo, West Indies.

*Remarks*.—No specimens of this species available for examination. Judged from the figure illustrating the species, it may or may not belong in one of the genera treated here, but it certainly is not a *Leucinodes*.

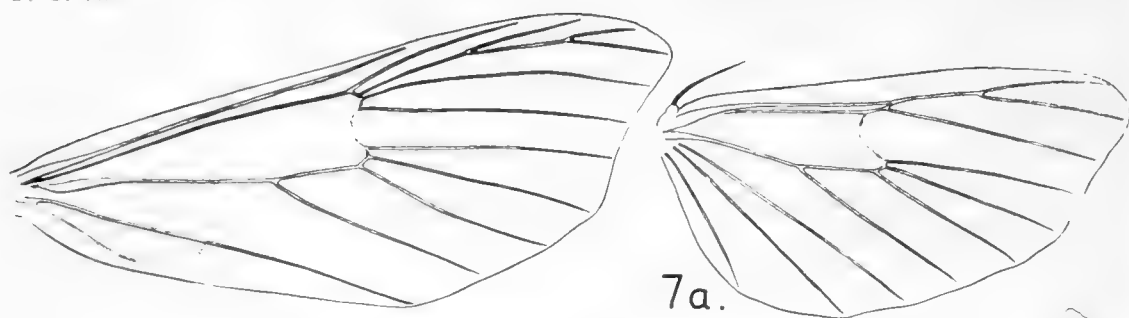
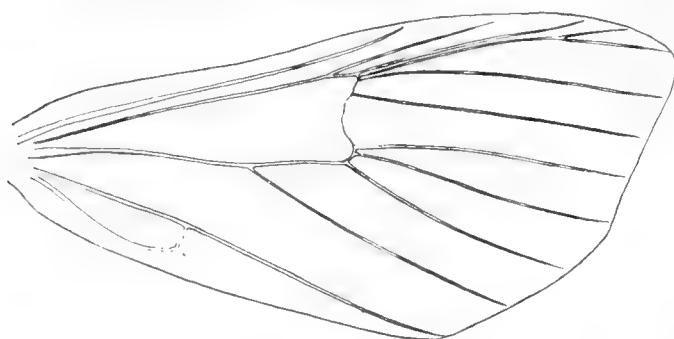
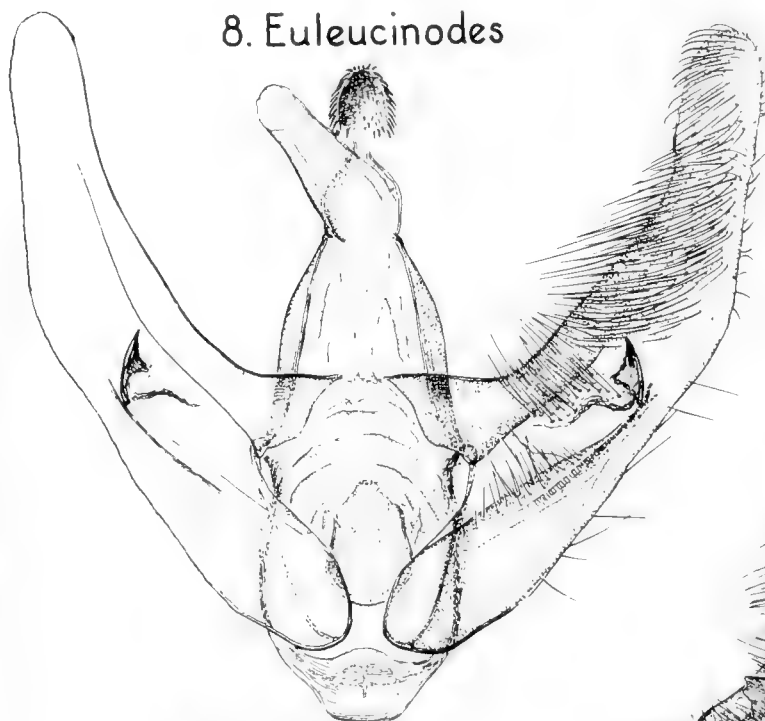
#### NOTE

The drawings for the plates were made by Arthur D. Cushman, scientific illustrator of the U. S. Bureau of Entomology and Plant Quarantine. All the drawings are from ventral view. Male genitalia have the aedeagus removed, and since they are symmetrical the left harpe has been left incomplete or omitted. In some cases only the right harpe and aedeagus are figured.

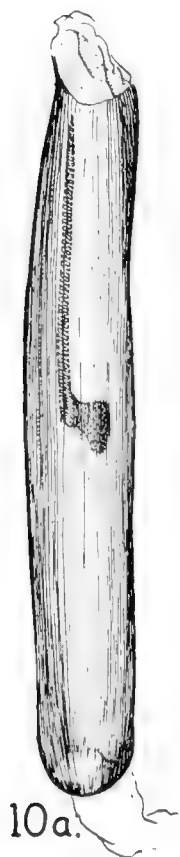
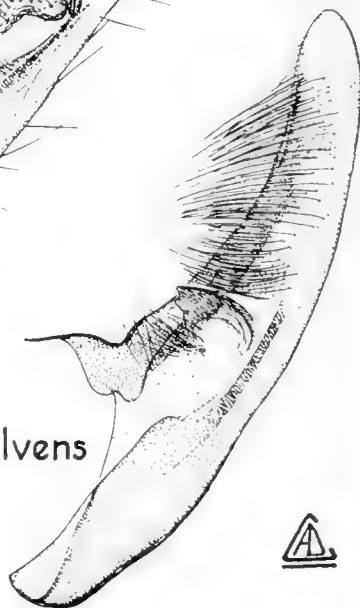






7. *Neoleucinodes*8. *Euleucinodes*9. *N. elegantalis*

9a.

10. *N. dissolvens*

10a.

7, 9, *Neoleucinodes elegantalis* (Guenée): 7, 7a, Venation of fore and hind wings; 9, male genitalia; 9a, aedeagus.

8, *Euleucinodes conifrons*, new species: Venation of forewing.

10, *Neoleucinodes dissolvens* (Dyar): 10, Right harpe; 10a, aedeagus.

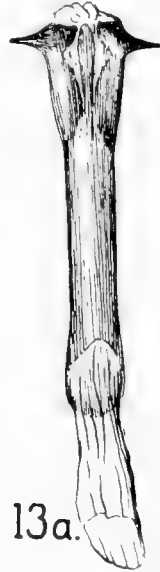


11a.

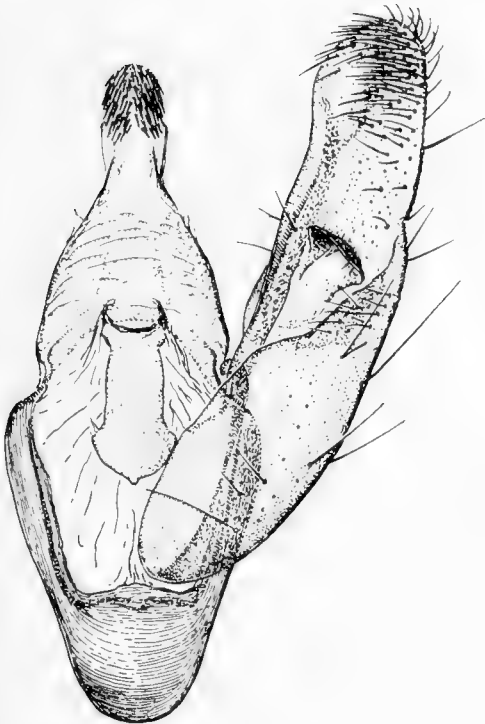
11. *N. prophetica*



12a.



13a.



12. *N. torvis*



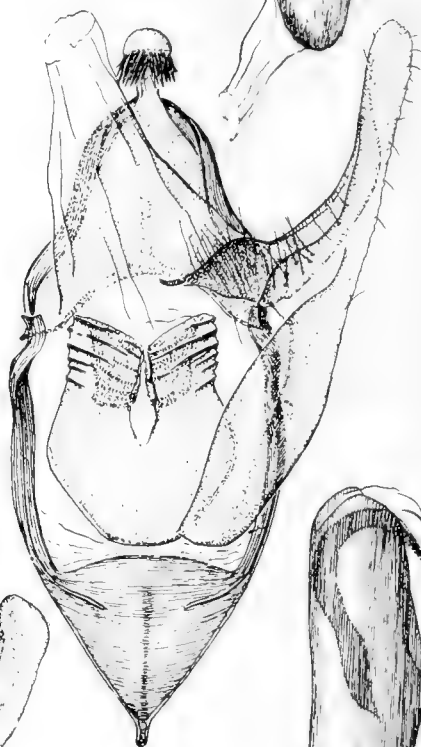
13. *N. imperialis*



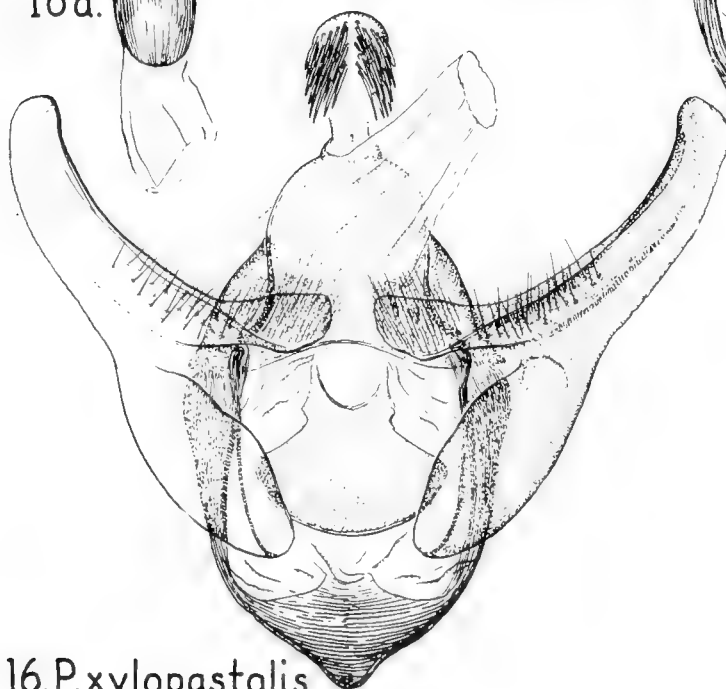
11, *Neoleucinodes prophetica* (Dyar): 11, Right harpe; 11a, aedeagus.  
 12, *Neoleucinodes torvis*, new species: 12, Male genitalia; 12a, aedeagus.  
 13, *Neoleucinodes imperialis* (Guenée): 13, Male genitalia; 13a, aedeagus.

14. *E. conifrons*

14a.

15. *P. melanoleuca*

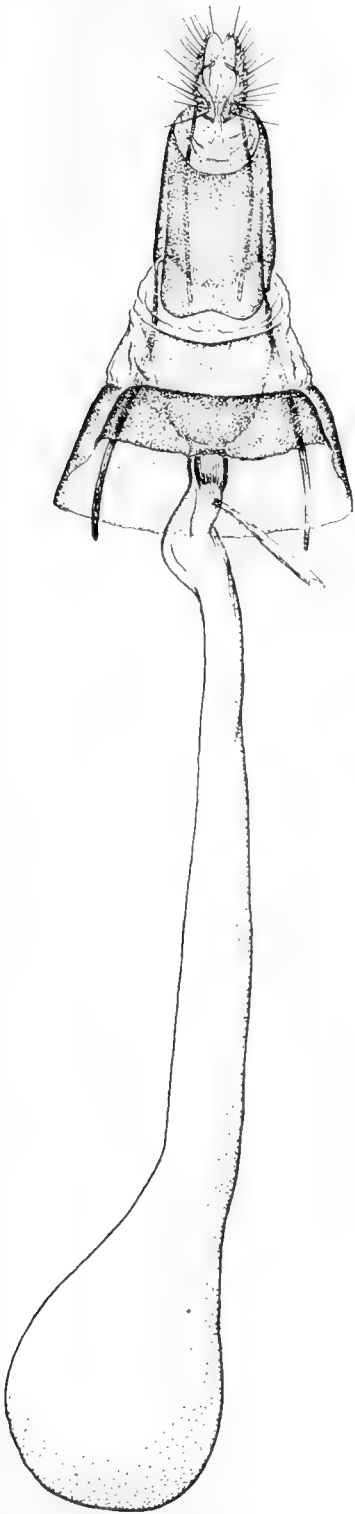
16a.

16. *P. xylopastalis*

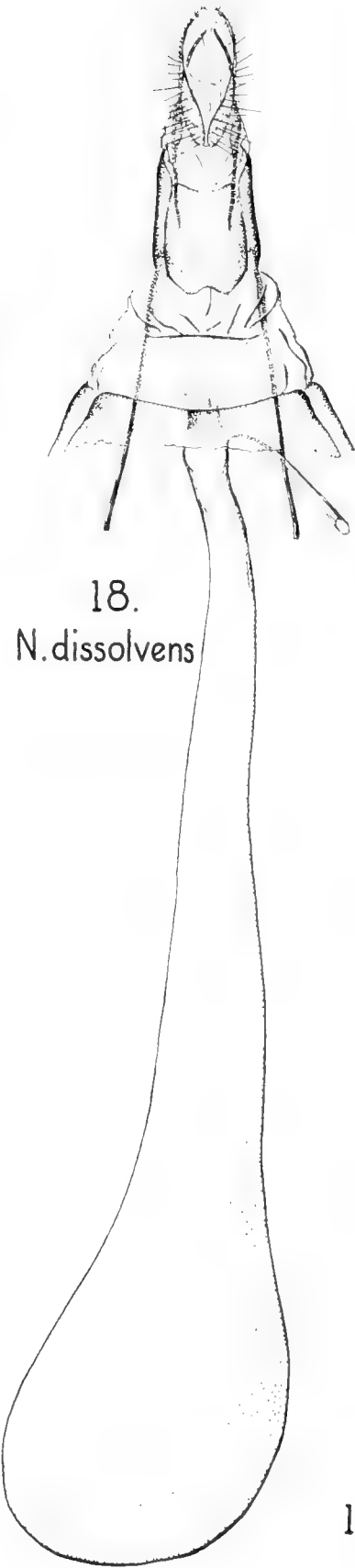
15a.



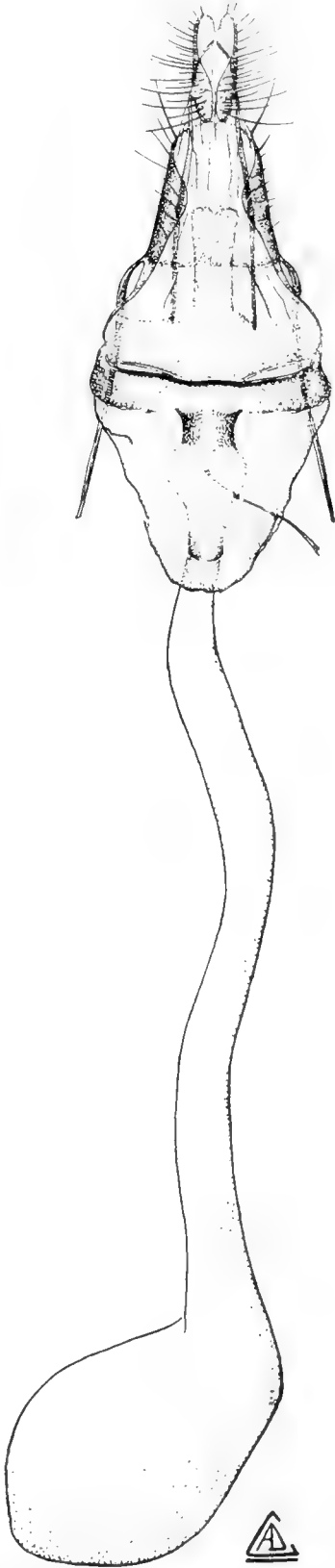
- 14, *Euleucinodes conifrons*, new species: 14, Male genitalia; 14a, aedeagus.  
 15, *Proleucinodes melanoleuca* (Hampson): 15, Male genitalia; 15a, aedeagus.  
 16, *Proleucinodes xylopastalis* (Schaus): 16, Male genitalia; 16a, aedeagus.



17. *N. elegantalis*

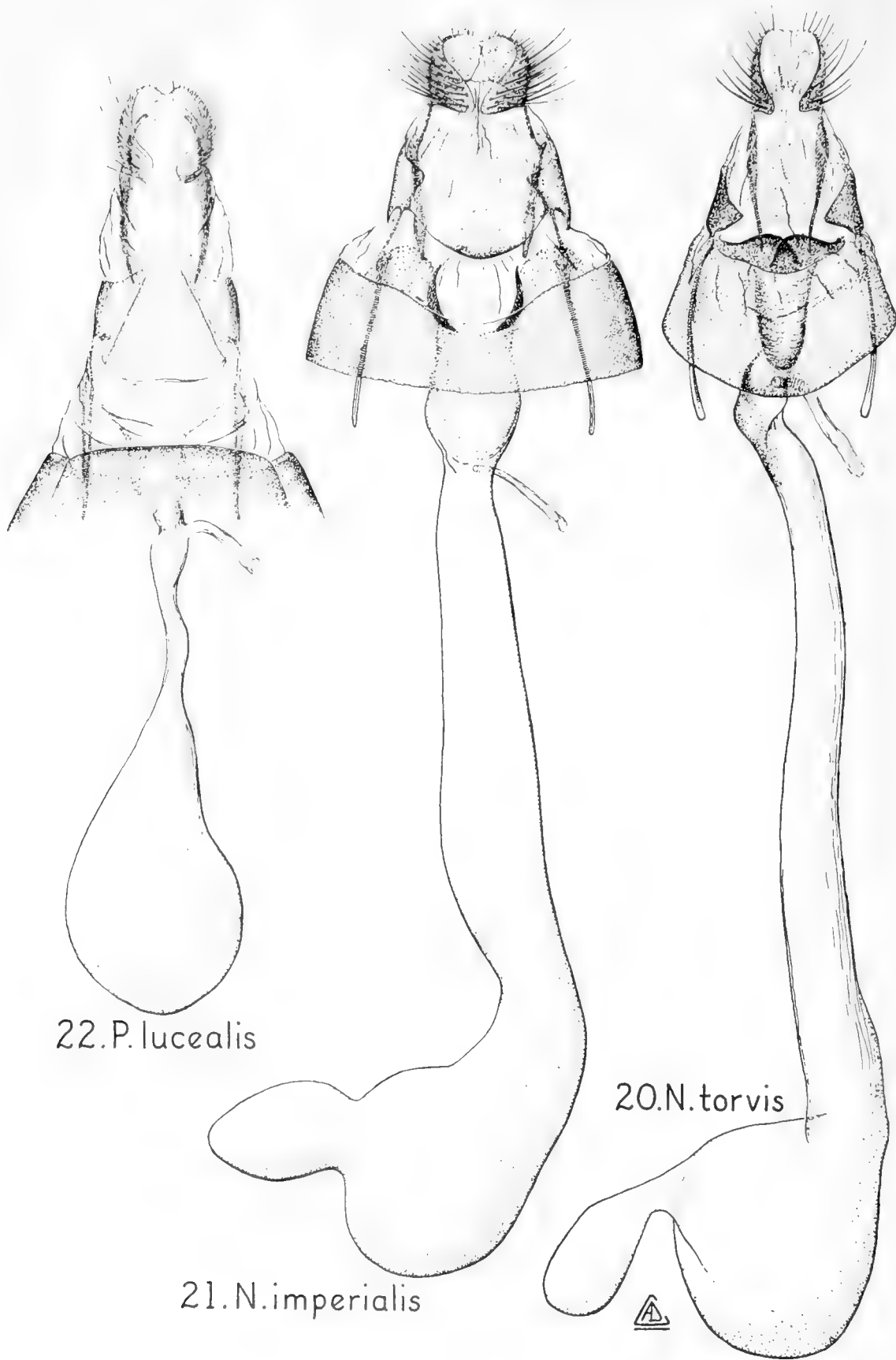


18.  
*N. dissolvens*



19. *N. prophetica*

17, *Neoleucinodes elegantalis* (Guenée): Female genitalia.  
18, *Neoleucinodes dissolvens* (Dyar): Female genitalia.  
19, *Neoleucinodes prophetica* (Dyar): Female genitalia.



20, *Neoleucinodes torvis*, new species: Female genitalia.

21, *Neoleucinodes imperialis* (Guenée): Female genitalia.

22, *Proleucinodes luccalis* (Felder and Rogenhofer): Female genitalia.



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## THE SERPHOID HYMENOPTERA OF THE FAMILY ROPRONIIDAE

By HENRY TOWNES

THE family Roproniidae (superfamily Serphoidea) contains only the genus *Ropronia*. In venation especially, *Ropronia* shows relationship with the genera *Helorus* and *Vanhornia*, placed in the families Heloridae and Vanhorniidae, respectively, but differs from these in several obvious characters of the head and abdomen which may justify its separation as a distinct family.

The general habitus is shown in figure 12, *a*. The specimen illustrated is a male. The female has a vomeriform subgenital plate and the ovipositor not exerted. The first abdominal segment forms a stalk for the remainder, which is compressed and projects upward from the stalk. This character, together with the 14-segmented antenna and the type of venation figured, easily distinguishes the Roproniidae from all other groups.

Specimens have been borrowed for study from all collections known to include members of the family. The location of individual specimens reported here is indicated in parentheses by the name of the owner for private collections, and the name of the city for institutional collections. All the types have been studied.

### Genus **ROPRONIA** Provancher

*Ropronia* PROVANCHER, Additions et corrections à la faune hyménoptérologique de la Province de Québec, p. 154, 1886.

Type: *Ropronia pediculata* Provancher. Monobasic.



Three species of *Ropronia* are known from the Nearctic Region, and a fourth described below probably from China, but the origin of the specimens described is not known with any certainty.

#### KEY TO THE SPECIES OF ROPRONIA

1. Head and thorax mostly or entirely ferruginous; postscutellum elevated as an acute pyramid; venation as in fig. 12, *b*----- 2. *californica* Ashmead  
Head and thorax black, sometimes marked with whitish; postscutellum convex, not conspicuously elevated----- 2
2. Nervulus meeting medial vein basad of basal vein (fig. 12, *c*); frons and top of head coarsely rugosopunctate----- 4. *pediculata* Provancher  
Nervulus meeting medial vein beyond basal vein (fig. 12, *a*, *d*); frons and top of head with small punctures----- 3
3. Forewing with a large fuscous spot below stigma (fig. 12, *d*).  
3. *brevicornis*, new species  
Forewing without a spot (fig. 12, *a*)----- 1. *garmani* Ashmead

#### 1. ROPRONIA GARMANI Ashmead

##### FIGURE 12, *a*

*Ropronia* (!) *garmani* ASHMEAD, Proc. Ent. Soc. Washington, vol. 4, p. 132, 1899.

Type: ♂, Lexington, Ky. (Washington).

*Thorax black, sometimes marked with whitish; forewing without a dark spot; nervulus meeting the medial vein basad of the basal vein.*

Forewing about 5.4 mm. long; face with a median dorsal longitudinal tubercle; frons and top of head with rather close, sharp, medium-sized punctures; second flagellar segment about 2.2 as long as deep in the male, about 3.0 as long as deep in the female; mesoscutum with medium-sized punctures separated by about 1.0 their diameter; scutellum with a median semicircular raised area; venation as in figure 12, *a*; first tergite about 4.0 as long as deep; second tergite polished.

Color unusually variable. Darker specimens are as follows: Black. Male with the second abdominal segment ferruginous with its base and apex infusate; female with the gaster ferruginous except that the subgenital plate and the base of the second segment are somewhat infusate, or the gaster rarely colored as in the male. A common variation of this coloration is to have the forecoxa, apex of the fore femur, foretibia, basal part of middle tibia, and apices of middle and hind tibiae paler (light brown to whitish). Unusually pale specimens are as follows: Black or blackish. Head except above, mouth parts, antenna except above, margins of pronotum of varying widths, upper anterior part of mesopleurum, tegula, trochanters, front and middle coxae, tarsi, front and middle tibiae, front femur except basally, apical parts of middle and hind femora, and basal 0.3 and apical 0.1 of hind tibia whitish to pale brown; abdomen colored as in the darker forms. Paler specimens are usually females.

Specimens: Many males and females from the District of Columbia (Georgetown); Georgia (Yonah Mountain); Iowa (Floyd and Musca-

tine Counties); Maryland (Bowie and Takoma Park); New Hampshire (Durham); New York (Bemus Point, Farmingdale, Ithaca, and Poughkeepsie); Ohio (Put in Bay); Pennsylvania (High Spire, Mount

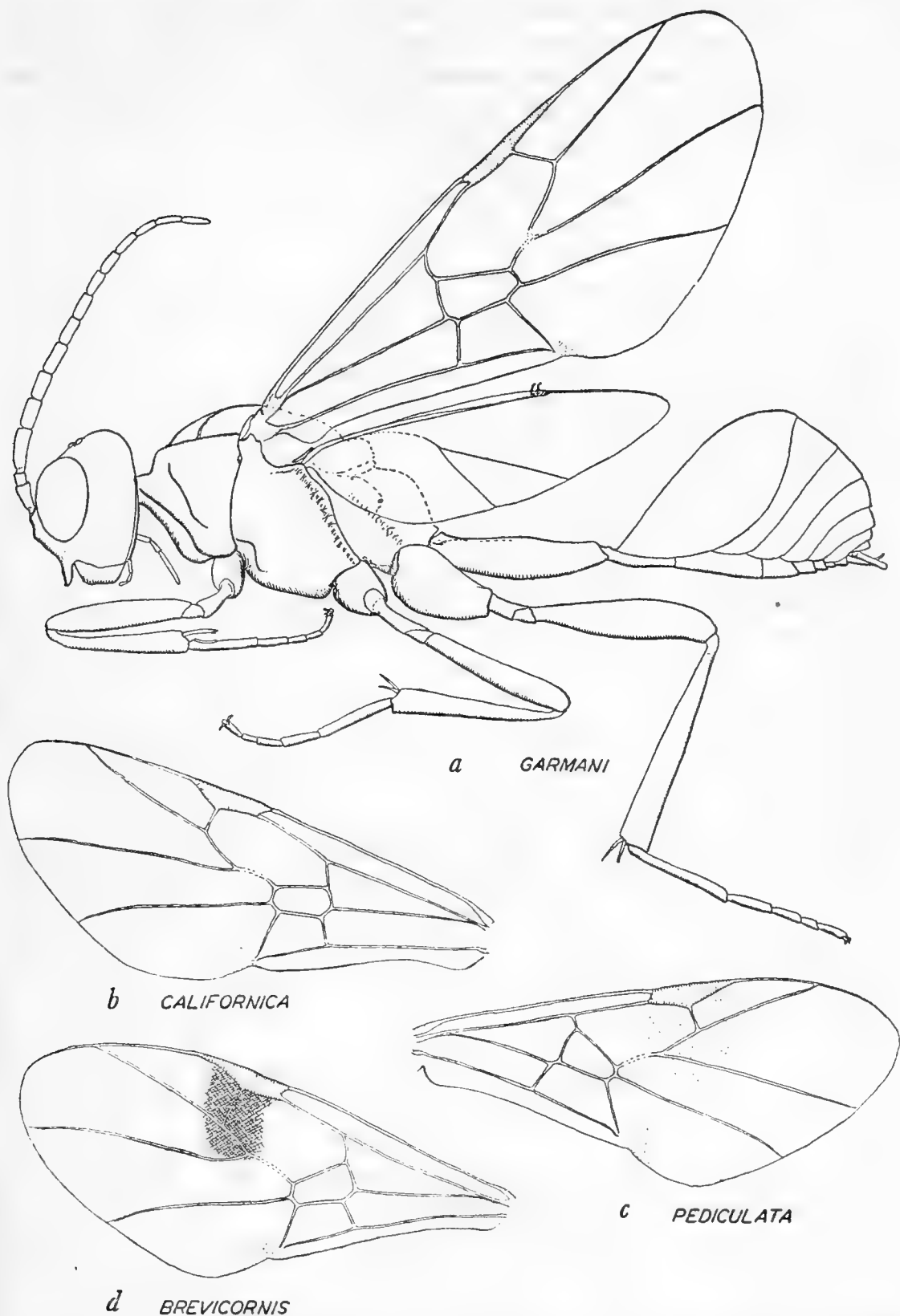


FIGURE 12.—a, *Ropronia garmani* Ashmead, male; b, venation in *Ropronia californica* Ashmead; c, venation in *Ropronia pediculata* Provancher; d, venation in *Ropronia brevicornis*, new species.

Holly Springs, Philadelphia, and West Chester); and Virginia (Falls Church, Great Falls, and Rosslyn).

This species appears confined to moist localities in the Transitional Zone of eastern North America. It is often moderately common among rank shaded vegetation along stream bottoms, as in places where *Impatiens* grows. Most adults are on the wing between June 20 and the end of July. The earliest and latest dates of capture are June 13 and August 31, both at Takoma Park, Md.

### 2. *ROPRONIA CALIFORNICA* Ashmead

FIGURE 12, b

*Roptronia* (!) *californica* ASHMEAD, Proc. Ent. Soc. Washington, vol. 4, p. 133, 1899. Type: ♂, southern California (Philadelphia).

*Head and thorax largely or entirely ferruginous.*

Forewing about 5.3 mm. long; face with a median dorsal longitudinal tubercle; frons irregularly rugose, with close small punctures; top of head with moderately close small punctures; second flagellar segment about 2.3 as long as deep in the male, about 3.0 as long as deep in the female; mesoscutum with rather small punctures separated by about 2.0 their diameter; scutellum with its median section elevated as a high pyramid that is about 1.2 as high as its basal diameter; venation as in figure 12, b; first tergite about 3.2 as long as deep; second tergite polished.

Ferruginous. Part or all of the thoracic sterna black. Sometimes, especially in males, the black thoracic markings are more extensive, the first tergite is entirely or partly black, and there is a black spot on the frons and enclosing the ocelli.

Specimens: ♀, Carrville, 2,400 to 2,500 feet, Trinity County, Calif., May 17, 1934, E. C. Van Dyke (San Francisco). ♂, Davis, Calif., April 6, 1936, R. M. Bohart (Townes). ♀, Davis, Calif., April 23, 1936, R. M. Bohart (Townes). ♀, Davis, Calif., May 1, 1936, R. M. Bohart (Bohart). ♂, Klamath Falls, Oreg., June 16, 1922, E. C. Van Dyke (San Francisco).

### 3. *ROPRONIA BREVICORNIS*, new species

FIGURE 12, d

*Forewing with a fuscous spot below the stigma (fig. 12, d); nervulus meeting the medial vein beyond the basal vein.*

Forewing about 3.9 mm. long; clypeus shorter and with larger foveae than in other species of the genus; face with a median vertical ridge extending its length; frons and top of head with medium-sized, rather close punctures, behind the ocelli with small, rather distant punctures; second flagellar segment of male about 1.6 as long as deep,

of female about 1.8 as long as deep; mesoscutum with medium sized punctures separated by about 0.8 their diameter; scutellum with a median semicircular raised area; venation as in figure 12, *d*; first tergite about 3.1 as long as deep; second tergite polished.

Black. Tarsi, front tibia, and apical part of front femur stramineous, the apex of the hind basitarsus and the second and following segments of the hind tarsus more or less infuscate; middle and hind tibiae often with an incomplete subbasal whitish band; forewing with a fuscous spot as indicated in figure 12, *d*; second and following tergites piceous.

Type: ♂, part of a series received by C. P. Clausen, October 1937, from C. R. Kellogg, Foochow, China (Washington, U. S. N. M. No. 18324). With the *Ropronia* was an adult and several cocoons of a *Perichlita* (Tenthredinidae) indicating that the *Ropronia* may have been reared from this as the host.

Paratypes: 9 ♂, 6 ♀ from the same source as the type (Washington and Townes).

#### 4. ROPRONIA PEDICULATA Provancher

FIGURE 12, *c*

*Ropronia pediculata* PROVANCHER, Additions et corrections à la faune hyménoptérologique de la Province de Québec, p. 154, 1886. Type: ♀, Ottawa, Ontario (Québec).

*Ropronia ashmeadii* Bradley, Ent. News, vol. 16, p. 117, 1905. Type: ♀, Larch Meadow, near Ithaca, N. Y. (Ithaca). New synonymy.

*Nervulus meeting the medial vein basad of the basal vein (fig. 12, c).*

Forewing about 5.0 mm. long; face with a median dorsal longitudinal tubercle; frons and top of head rugose, not distinctly punctate; second flagellar segment of female about 2.8 as long as deep; mesoscutum irregularly punctate with large punctures, anteromedially with an area of close fine punctures; scutellum with a median semicircular raised area (somewhat deformed in the type of *R. ashmeadii*); venation as in figure 12, *c*; first tergite about 2.9 as long as deep; second tergite weakly mat.

Black. Mandible except basally, front tibia, and front femur except basally dark ferruginous; fore wing with a large faintly infuscate spot as indicated in figure 12, *c*; second and following tergites ferruginous except that the basal part of the second is blackish.

Specimens: ♀, near Ithaca, N. Y., July 9, 1904 (Ithaca, type of *R. ashmeadii*). ♀, Point Pelee, Ontario, July 20 to 30, R. C. Osburn (Columbus). These specimens agree with notes made in 1941 on the venation and the sculpture of the head and thorax of the type of *R. pediculata*.



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## PARASITIC WASPS OF THE GENUS *TRIMORUS* IN NORTH AMERICA

By ROBERT M. FOUTS

ARNOLD FOERSTER established the genus *Trimorus* in 1856,<sup>1</sup> indicating as representatives *Gryon nanno* Walker and *Gryon phlias* Walker. These two species differed from other species of *Gryon* Walker in having the parapsidal grooves distinct, the metanotum armed with a strong though short spine, and the abdomen elongate. Foerster, not having before him any specimens referable to *Trimorus*, stated erroneously that the genus was characterized by having the marginal vein short and the postmarginal vein very long. According to Kieffer<sup>2</sup> the types of *nanno* and *phlias* have the marginal vein very long and the postmarginal vein absent. Ashmead in 1893<sup>3</sup> perpetuated Foerster's error when he redescribed *Trimorus* and included his new species *americanus*. This species has been made the type of the genus *Protrimorus* Kieffer.

Ashmead's numerous species of *Prosacantha*<sup>4</sup> were removed from that genus by Kieffer in 1908,<sup>5</sup> and, since they differed from *Hoplogryon* Ashmead only in the relative length and width of the petiole, a character of doubtful generic value, they were referred to that genus.

Alan P. Dodd, in 1930,<sup>6</sup> wrote a paper on the Australian Teleasinae in which he described many new Australian species and discussed the relationships of the genera, presenting a key to all those recognized by him. He showed that the two genera *Trimorus* Foerster and *Hop-*

<sup>1</sup> Hymenopterologische Studien, vol. 2, pp. 101, 104, 1856.

<sup>2</sup> Ann. Soc. Sci. Bruxelles, vol. 32, p. 191, 1908.

<sup>3</sup> U. S. Nat. Mus. Bull. 45, p. 138, 1893.

<sup>4</sup> *Ibid.*, pp. 185-198.

<sup>5</sup> Ann. Soc. Sci. Bruxelles, vol. 32, p. 200, 1908.

<sup>6</sup> Proc. Linn. Soc. New South Wales, vol. 55, pp. 41-91, 1930.

*logryon* Ashmead, which allegedly differ only in having the parapsidal grooves complete or incomplete (sometimes absent), cannot be separated. Several species are described in Mr. Dodd's paper which have the parapsidal grooves present in the male but absent in the female. I have found that it is sometimes difficult to determine whether the parapsidal grooves are complete or even whether they are present at all.

More recently, G. E. J. Nixon, of the British Museum, has written a paper on African Teleasinae<sup>7</sup> in which he describes, with accompanying keys and numerous excellent illustrations, 3 new species of *Trimorus*, 24 new species of *Hoplogryon*, and 1 new genus (with 3 new species), all from South Africa, except one species from Kenya and one from Nyassaland. His new genus *Macrogyron* may be synonymous with *Gryonoides* Dodd (1919), differing, as far as I can determine from the descriptions, only in the larger size of its representatives and in having the eyes pubescent.

Little is known of the habits of the wasps belonging to the subfamily Teleasinae. In Europe one species of *Trimorus* and one of *Teleas* are parasites of a species of *Scolytus*; one species of *Trimorus* and one of *Teleas* are guests of *Lasius fuliginosus* (Latreille); one species of *Paragryon* is a guest of *Lasius flavus* (Fabricius); and one species of *Trimorus* was reared from the gall of *Rhabdophaga rosaria* Loew. In the United States *Trimorus bethunei* (Sanders) is recorded as a guest of *Formica subrufa* Roger, and *Trimorus caraborum* (Riley) is recorded as being parasitic in the eggs of the carabid beetle *Chlaenius impunctifrons* Say.

The following key may be used to separate the genera of the subfamily Teleasinae:

1. Second abdominal segment longer than third..... **Gryon** Haliday  
    Second abdominal segment shorter than third..... 2
2. Scutellum armed with a spine on each side..... 3  
    Scutellum unarmed..... 4
3. Eyes bare; body 2 mm. or less in length..... **Gryonoides** Dodd  
    Eyes clothed sparsely with fairly long hairs; body not less than 4.8 mm. in length..... **Macrogyron** Nixon
4. Legs stout, the femora thickened..... 5  
    Legs slender, the femora not thickened..... 6
5. Metanotum with one tooth or spine..... **Teleas** Latreille  
    Metanotum bidentate..... **Gryonella** Dodd
6. Male antenna with whorls of long hairs; parapsidal grooves deep and abbreviated..... **Xenomerus** Walker  
    Male antennae merely pubescent; parapsidal grooves absent or delicate, not deep..... 7
7. Metanotum unarmed..... **Paragryon** Kieffer  
    Metanotum with one tooth or spine..... **Trimorus** Foerster  
    Metanotum with three teeth or spines..... **Trissacantha** Ashmead

<sup>7</sup> Ann. Mag. Nat. Hist., ser. 10, vol. 17, pp. 114-191, 18 figs., 1936.



Genus TRIMORUS Foerster<sup>8</sup>

- Trimorus* FOERSTER, Hymenopterologische Studien, vol. 2, pp. 101, 104, 1856.—KIEFFER, Ann. Soc. Sci. Bruxelles, vol. 32, p. 191, 1908; Genera insectorum, fasc. 80B, p. 98, 1910; Das Tierreich, Lief. 48, pp. 176–182, 1926.—DODD, Proc. Linn. Soc. New South Wales, vol. 55, pp. 41–91, 1930.—NIXON, Ann. Mag. Nat. Hist., ser. 10, vol. 17, pp. 116–123, 1936.
- Prosacantha* THOMSON (*non* Nees, 1834), Öfv. Vet.-Akad. Förh., vol. 15, pp. 421–431, 1859.—ASHMEAD, U. S. Nat. Mus. Bull. 45, pp. 185–198, 1893.—KIEFFER, Ann. Soc. Sci. Bruxelles, vol. 30, p. 162, 1906.—BRUES, Genera insectorum, fasc. 80, pp. 21–22, 1908; Connecticut Geol. Nat. Hist. Surv. Bull. 22, p. 552, 1916.
- Hoplogryon* ASHMEAD, U. S. Nat. Mus. Bull. 45, pp. 200–205, 1893.—KIEFFER, Ann. Soc. Sci. Bruxelles, vol. 32, pp. 200–238, 1908.—BRUES, Genera insectorum, fasc. 80, p. 159, 1908.—KIEFFER, Spécies des hyménoptères d'Europe et d'Algérie, vol. 11, p. 168, 1913; Das Tierreich, Lief. 48, pp. 182–234, 1926.—NIXON, Ann. Mag. Nat. Hist., ser. 10, vol. 17, pp. 123–141, 161–181, 1936.
- Pentacantha* KIEFFER (part), Ann. Soc. Sci. Bruxelles, vol. 32, pp. 239–250, 1908; (part) Genera insectorum, fasc. 80B, p. 93, 1910.
- Hemimorus* CAMERON, Soc. Ent., Stuttgart, Jahrg. 27, p. 77, 1912.
- Propentacantha* KIEFFER (part), Das Tierreich, Lief. 48, p. 251, 1926.

The more important characters of the genus are as follows: Head transverse; ocelli close together, the lateral ones remote from the eye margin; antennae 12-jointed in both sexes, in the female with a compact 6-jointed club, in the male filiform, the flagellar joints usually long; thorax stout; pronotum not or scarcely visible from above; parapsidal grooves absent, complete, or partly complete; scutellum semicircular, unarmed; metanotum with one tooth or spine which may be very short, hardly distinguishable, or long, extending well over the petiole; propodeum short, frequently armed with a tooth at the posterior angles; front wings often abbreviated, in one Nearctic species absent; marginal vein very long, much longer than the stigmal vein; radius short; postmarginal vein absent; abdomen rather short, broadly oval, narrowed at base; first segment subpetiolate, sometimes with a slight basal prominence in the female; third segment the longest; segments 4–6 short.

## CHARACTERS USED IN CLASSIFICATION

Characters found in the surface sculpture of the frons, mesonotum, and the first three tergites of the abdomen have proved to be the most useful and reliable. A median carina usually extends from the bases of the antennae all the way to the anterior ocellus. In one species this carina is entirely absent and in several others it is shortened above, not present below the ocellus. All the species known to the author have striations on the frons. These striae are usually short, but in some species they tend to become longer and sometimes extend the

<sup>8</sup> Order Hymenoptera: family Scelionidae: subfamily Telcasinae.

entire length of the frons. The upper half of the frons may be reticulate, punctate, striate, without sculpture, or it may be reticulate and punctate, the clearness and depth of the markings different in various species.

The mesonotum may have a fine sculpture, in which case it is usually more or less distinctly scaly-reticulate, sometimes more or less wrinkled anteriorly, or it may have a much coarser sculpture, in which case it is punctate or variously wrinkled, not usually distinctly reticulate. The parapsidal grooves may be complete or nearly complete whether the general surface sculpture is fine or coarse, but they are usually shorter in those species with fine mesonotal sculpture. When the sculpture is strong the parapsidal grooves are often traced only with difficulty. It is sometimes difficult to make sure that the groove one is trying to follow is not just one of many furrows in a much wrinkled surface. Wrinkles posteriorly on the mesonotum appear always to run longitudinally; those situated anteriorly are apparently always directed transversely.

The shape and sculpture of the first, second, and third tergites present many characters of value in separating species and groups of species. The petiole varies, in different species, from broadly transverse to distinctly longer than wide (measured across base). The dorsal surface is always traversed by longitudinal ridges separated by more or less profound grooves. In the majority of the Nearctic species these ridges extend the entire length of the segment or nearly so. Several species, however, have the ridges very short, present only across the middle. In the female the petiole may be protuberant anteriorly, the longitudinal ridges not present on the swollen portion. A trough-shaped depression sometimes crosses the petiole, the ridges traversing it. In several species the anterior margin is narrowly reflexed.

The second tergite is always, as far as the author knows, wider (measured across base) than long, but the proportions are somewhat different in the various species. Like the petiole this segment is traversed by longitudinal ridges, or by deep grooves with the upper edges of the intervening ridges on a level with the general surface. Usually the ridges are longest medially, becoming progressively shorter as they approach the lateral margins. A few species have all the ridges equally long, their termini forming a straight line parallel with the posterior margin. In some species with shorter lateral ridges the second tergite is reticulate toward the sides.

Unlike the petiole and the second tergite the third tergite has no set form of sculpture. The surface may be partly or entirely striate, partly or entirely reticulate with the enclosed areas varying in size and the impressions varying in depth, or punctate, the pits varying in

size, depth, and number, or without sculpture of any kind, the surface smooth and polished. Punctures may accompany striation or reticulation or they may be the only type of sculpture present. Whatever the kind or kinds of sculpture present the lateral margins are usually broadly and the posterior margin narrowly smooth and polished, without sculpture. Pubescence may be evenly distributed over the surface of the segment or may be sparser medially. In a number of instances pubescence is entirely lacking medially.

There are, of course, a number of other characters more or less of value in classifying the species of this genus. The comparative and actual length of the front wing, the comparative lengths and widths of the head, thorax, abdomen, and antennal joints, and the colors of the body and appendages are all characters of importance in certain instances.

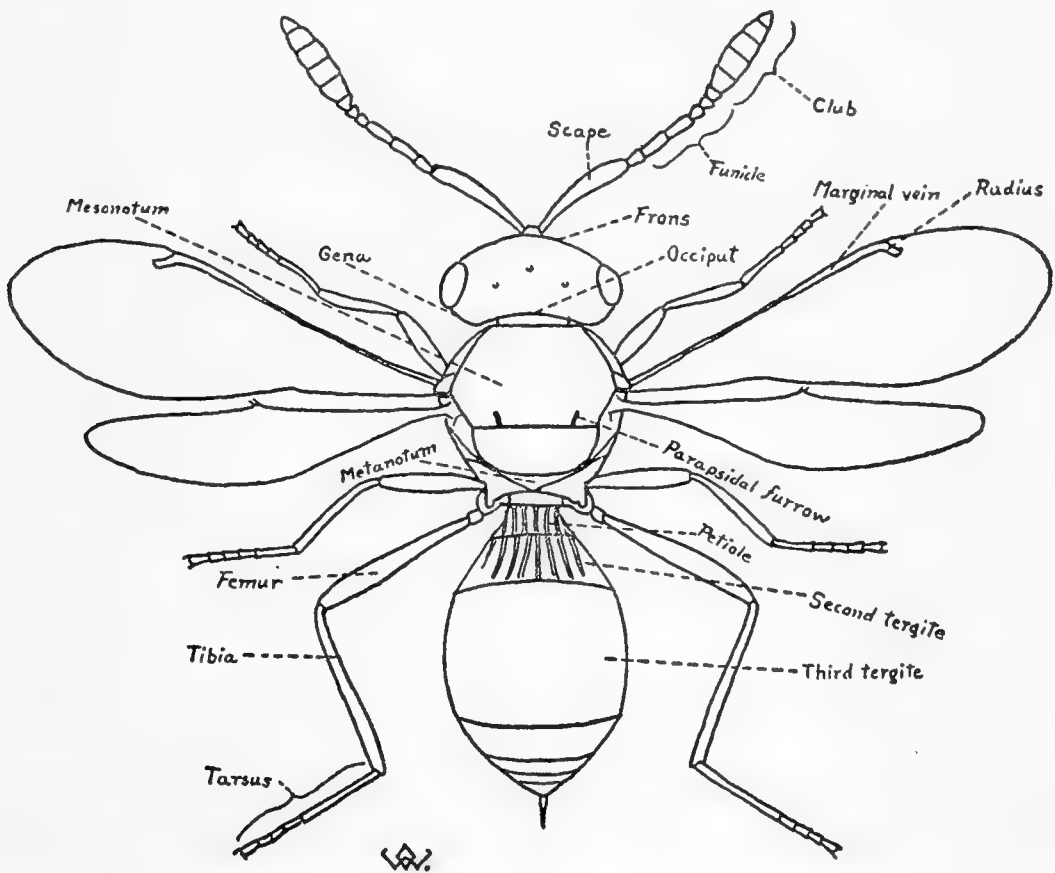


FIGURE 13.—Structure of *Trimorus*: Female of *Trimorus nigricoxa*, new species. Drawn by Oscar Whittaker.

## GEOGRAPHICAL DISTRIBUTION OF THE SPECIES

REGION	NUMBER OF SPECIES
Nearctic.....	92
New York.....	11
Pennsylvania.....	4
District of Columbia.....	17
Maryland.....	16
Virginia.....	10
Carolina.....	1
Florida.....	7
Iowa.....	1
Kansas.....	1
Illinois.....	1
Texas.....	4
Nevada.....	1
Utah.....	2
Oregon.....	1
California.....	2
Ontario.....	6
British Columbia.....	22
Neotropical.....	6
St. Vincent.....	3
Grenada.....	1
Cuba.....	1
Brazil.....	1
Palaearctic.....	99
Europe.....	98
Madeira Islands.....	1
Ethiopian.....	28
British East Africa.....	2
South Africa.....	26
Oriental.....	10
Java.....	3
Philippine Islands.....	7
Australasian.....	43
Australia.....	42
Tasmania.....	1
TOTAL NUMBER OF SPECIES.....	278

As indicated in the foregoing tabulation, representatives of the genus *Trimorus* have been found in all the primary zoogeographical regions. Few species have been described from the Neotropical and Oriental Regions. This paucity of described species is no indication that the genus is poorly represented but rather that little collecting has been done. It is probable that many undescribed species occur in these regions.

It may be observed that the total for the figures in the right hand column is somewhat greater than that for the figures on the left. This is so because some species have been recorded from more than one of the areas listed. A few species occur in widely separated areas in North America. *T. brevicarinatus*, for instance, is known to occur in

Maryland, District of Columbia, and Texas. *T. melanopus*, originally described from Ontario, has recently been collected in British Columbia. No species, so far as known, occurs in any two of the six primary zoogeographical regions.

Alan P. Dodd, Oscar Whittaker, and G. E. J. Nixon have contributed greatly to our knowledge of the species of Australia, of British Columbia, and of South Africa. All the 43 Australasian species of *Trimorus* have been described by Mr. Dodd. All the 22 new species from British Columbia are described from material collected by Mr. Whittaker. His generosity in sending this material to the author for study has made possible a substantial increase in our knowledge of Nearctic species. All but one of the 28 Ethiopian species were described by Mr. Nixon.

The key presented herewith is a development and expansion of a preliminary one prepared by the author in 1926. This included all Ashmead's species of *Hoplogryon*, some of Ashmead's species of *Prosacantha*, Gahan's *Hoplogryon kansasensis*, and undescribed species in the author's collection. Several of Ashmead's species of *Prosacantha*, e. g., *californica*, *gracilicornis*, *linellii*, *macrocera*, *minutissima*, *schwarzii*, and *xanthognatha* and all species described by Kieffer, Brues, and Sanders, were not included in the original key and are now placed, or their approximate positions indicated, solely on the basis of the literature concerning them. Notes made by the author on the type material indicate that *Prosacantha americana* Ashmead and *Hoplogryon obscuripes* Ashmead should be transferred to the genera *Teleas* Latreille and *Paragryon* Kieffer, respectively.

#### KEY TO NEARCTIC SPECIES OF TRIMORUS

1. Wings absent or abbreviated..... 2  
    Wings normally developed..... 17
2. Wings absent..... (1) **apterus**, new species  
    Wings abbreviated..... 3
3. Wings extending to or past apex of petiole..... 4  
    Wings not extending past apex of propodeum..... 8
4. Petiole black, elevated anteriorly; third tergite strongly reticulate.  
    (2) **utahensis** (Ashmead)  
    Petiole black or reddish, not elevated anteriorly..... 5
5. Body and antennae entirely black; third tergite smooth, without sculpture.  
    (3) **formosus**, new species  
    Petiole reddish; third tergite reticulate, if punctate then with striae  
    basally..... 6
6. Thorax mostly reddish; proximal four antennal joints and legs yellow... 7  
    Thorax black or very dark brown; antennae black or dark brown, scape brown-  
    ish basally; legs yellow to light brown..... (4) **bruesi** (Kieffer)
7. Wings extending to apex of petiole, ciliated; mesonotum strongly punctate,  
    punctures almost confluent; third tergite smooth, with a few scattered  
    punctures; mandibles with two long, equal teeth..... (5) **grandis** (Brues)

- Wings extending to about middle of second tergite, not ciliated; mesonotum not so strongly punctate, punctures for most part clearly separated; third tergite irregularly striate toward base, with sparse scattered punctures; left mandible with three teeth..... (6) **pulchricornis**, new species
8. Third tergite closely punctate, not reticulate..... (7) **crassellus**, new name  
Third tergite not closely punctate, distinctly reticulate..... 9
9. Legs, reddish yellow..... (8) **solitarius** (Ashmead)  
Legs mostly darker..... 10
10. Frons just below anterior ocellus not or very delicately sculptured..... 11  
Frons just below anterior ocellus strongly sculptured..... 12
11. Frons with a very fine impressed line from antennae to anterior ocellus, without striae around base of this impressed line; third tergite 1.4 times as wide as long..... (9) **nitidus**, new species  
Frons with a distinct impressed median line, striate just above antennae; third tergite 1.5 times as wide as long..... (10) **exilis**, new species
12. Frons strongly convex; head about one and one-fourth times as wide as long. (11) **crassiceps**, new species  
Frons not strongly convex; head about twice as wide as long..... 13
13. Petiole with a trough-shaped depression across middle..... 14  
Petiole not depressed across middle..... 15
14. Third tergite faintly reticulate; posterior tibiae reddish brown. (12) **punctithorax**, new species  
Third tergite with impressed reticulation; posterior tibiae dark brown, reddish yellow basally..... (13) **subapterus**, new species
15. Legs brownish; coxae brown..... (14) **rufosignatus** (Kieffer)  
Coxae, femora, and tibiae (except the latter proximally) black or very dark brown..... 16
16. Body 1.42 mm. in length..... (15) **robustus**, new species  
Smaller, body 1.18 mm. in length..... (16) **finitimus**, new species
17. Parapsidal grooves more or less well defined, complete or nearly so..... 18  
Mesonotum variously sculptured, parapsidal grooves sometimes partly indicated, never complete and always more or less obscured by sculpture.. 31
18. Mesonotum punctate, striate posteriorly..... 19  
Mesonotum may be either partly punctate or partly striate but not both.. 20
19. Mesonotum rugose anteriorly; scutellum smooth, slightly roughened at anterior margin; parapsidal grooves distinct entire length of mesonotum..... (17) **pallidipes** (Ashmead)  
Mesonotum not rugose anteriorly; scutellum strongly reticulate, high ridges separating enclosed areas; parapsidal grooves perceptible but not sharply defined, difficult to detect posteriorly in coarse sculpture. (18) **striopunctatus**, new species
20. Third tergite with sculpture..... 21  
Third tergite without sculpture..... 26
21. Third tergite punctate, not striate toward base. (19) **erythrogaster**, new species  
Third tergite striate toward base ..... 22
22. Mesonotum longitudinally striate posteriorly ..... (20) **sulcatus** (Kieffer)  
Mesonotum not striate..... 23
23. Scape entirely light yellowish brown ..... (21) **erythropus** (Ashmead)  
Scape black entirely or in part ..... 24
24. Scape yellow basally; legs yellow or light brown.. (22) **crosbyi**, new species  
Scape entirely black; legs mostly dark brown..... 25

25. No median carina on upper half of frons; ridges on second tergite nearly reaching apex of segment----- (23) **distinctus**, new species  
 A sharp median carina to anterior ocellus; ridges medially on second tergite not extending past basal two-thirds----- (24) **percurrens**, new species
26. Petiole black or faintly reddish brown; coxae black or dark brown----- 27  
 Petiole and base of second tergite reddish yellow; coxae light yellowish brown----- (25) **minutus**, new species
27. Parapsidal grooves not present anteriorly ----- (26) **tenuicornis** (Kieffer)  
 Parapsidal grooves complete ----- 28
28. Frons with a few short striae immediately below anterior ocellus; wings brownish; species larger, about 1.7 mm. in length----- 29  
 Frons without striae below anterior ocellus; wings hyaline; species smaller, about 1.0 mm. in length----- 30
29. Mesonotum not roughened (except posteriorly where it is irregularly striate), reticulate, the areas very minute; scutellum smooth, with a few scattered punctures, with only a few fine scattered hairs. (27) **lionotus**, new species  
 Mesonotum roughened, scaly-punctate, not irregularly striate posteriorly; scutellum rather thickly pubescent, scaly-punctate anteriorly.  
 (28) **pictus**, new species
30. Mesonotum with a very fine scaly-reticulate sculpture; second tergite with ridges medially on basal two-thirds----- (29) **improcerus**, new species  
 Mesonotum with similar but stronger sculpture; second tergite with ridges medially on basal four-fifths ----- (30) **notabilis**, new species
31. Third tergite striate or with low ridges, at least in part----- 32  
 Third tergite not striate and without low ridges----- 50
32. Petiole and thorax (in part) reddish----- (31) **varius**, new species  
 Thorax black or dark brown (dark reddish brown laterally, black above in *flavicoxa*) ----- 33
33. Posterior coxae light in color----- 34  
 Posterior coxae black or mostly black----- 45
34. Striae usually strong, extending past middle of third tergite----- 35  
 Striae not extending past middle of third tergite, or striae few, and, though extending past middle, very fine and interrupted----- 40
35. Third tergite with numerous large punctures. (32) **marylandicus** (Ashmead)  
 Third tergite not punctate or with only a few small punctures laterally--- 36
36. Frons with a strong median carina; upper frons striate----- 37  
 Frons without a median carina or with a short low carina below----- 38
37. Scape brownish basally; striae on frons interrupted medially on each side of median carina; striae in middle of third tergite shorter, scarcely extending past middle----- (33) **striatifrons** (Ashmead)  
 Scape black; striae on frons not interrupted medially; all striae on third tergite of equal length, nearly attaining apex of segment.  
 (34) **rubripes**, new species, **rufocoxalis**, new variety
38. Frons punctate above; mesonotum posteriorly punctate; metanotal spine long and sharp; lateral angles of propodeum prominent, acute; striae on third tergite strong and regular, especially medially; petiole black.  
 (35) **kansasensis** (Gahan)  
 Frons without distinct sculpture above; mesonotum posteriorly not punctate; metanotal spine short, inconspicuous; striae on third tergite not so strong, more or less irregular and confluent----- 39
39. Mesonotum posteriorly longitudinally striate; petiole yellowish brown, lighter in color than rest of abdomen----- (36) **striativentris** (Ashmead)  
 Mesonotum reticulate; abdomen mostly reddish brown.  
 (37) **repentinus**, new species



40. Legs mostly dark brown.....(38) **brunneipes**, new species  
 Legs mostly lighter in color..... 41
41. Mesonotum anteriorly finely punctate..... 42  
 Mesonotum anteriorly coarsely punctate..... 43
42. Petiole elevated anteriorly..... (39) **pusillus** (Ashmead)  
 Petiole not elevated anteriorly..... (40) **columbianus** (Ashmead)
43. Scape and pedicel light reddish brown..... (41) **flavicoxa** (Ashmead)  
 Scape not entirely light reddish brown..... 44
44. Frons not striate except shortly below and narrowly laterally.  
 (42) **xanthopus**, new species  
 Frons entirely strongly striate..... (43) **fuscipennis** (Ashmead)
45. Third tergite not distinctly punctate..... 46  
 Third tergite punctate..... 47
46. Third sternite strongly striate..... 48  
 Third sternite not striate; mesonotum coarsely and thickly punctate.  
 (44) **nigripes** (Ashmead)
47. Third antennal joint about twice as long as thick.  
 (45) **jucundus**, new species  
 Third antennal joint about four and one-half times as long as thick.  
 (46) **caraborum** (Riley)
48. Frons entirely strongly carinate.  
 (34) **rubripes**, new species, **rubripes**, new variety  
 Frons with at least a median area that is not carinate..... 49
49. Frons above with strong beadlike sculpture; striae on third tergite few and  
 extending only slightly past middle..... (47) **leonardi**, new species  
 Frons without beadlike sculpture; striae on third tergite numerous and  
 nearly attaining apex..... (48) **punctiventris** (Ashmead)
50. Thorax reddish laterally and partly reddish above..... 51  
 Thorax black above at least..... 52
51. Antennal joints 3, 4, and 5 reddish brown... (49) **annulicornis** (Ashmead)  
 Antennal joints 3, 4, and 5 black..... (50) **pleuralis** (Ashmead)
52. Petiole reddish or yellowish, lighter than rest of abdomen..... 53  
 Petiole not decidedly lighter than rest of abdomen..... 56
53. Third tergite reticulate..... 54  
 Third tergite closely punctate..... (51) **sculpturatus**, new species
54. Only basal half of second tergite with grooves... (52) **petiolatus**, new species  
 Grooves nearly attaining apex of second tergite..... 55
55. Mesonotum thickly punctate, subopaque; petiole red; legs reddish brown,  
 the coxae dark brown; petiole about one and one-third times as wide as  
 long..... (53) **rufocinctus**, new series  
 Mesonotum with a moderately fine sculpture, reticulate-punctate; petiole  
 yellowish, about one and one-half times as wide as long; legs, including  
 coxae, light brown..... (54) **flavocinctus**, new species
56. Third tergite without sculpture or very faintly reticulate (*pennsylvanica*) or  
 aciculate..... 57  
 Third tergite distinctly reticulate..... 65  
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(1) *TRIMORUS APTERUS*, new species

*Female*.—Length 0.82 mm. Head about twice as wide as long, about one and one-seventh times as wide as the thorax; occiput, vertex, and mesonotum with dense impressed reticulation; upper half of frons pubescent and finely reticulate; below on the sides the frons is striate; just above these striae on each side is a small reticulate area; median carina very fine, apparently not quite attaining the anterior ocellus; frons except as noted above smooth, without sculpture; scutellum smooth, reticulate anteriorly; parapsidal grooves very short; spine on metanotum short, a mere tubercle, acute at apex; thorax about as wide as long; lateral angles of propodeum scarcely projecting; wings wanting; abdomen not quite one and two-thirds times as long as wide, 2.2 times as long as the thorax, 1.3 times as wide as the thorax; petiole about twice as wide as long, with 9 or 10 grooves extending its entire length; second tergite twice as wide as long, twice as long as the petiole, with numerous small ridges extending to apical fifth, the grooves between the ridges are deep anteriorly but shallow and with flat bottoms posteriorly; third tergite one and one-third times as wide as long, 2.6 times as long as the second, pubescent, sparsely so medially, and with faint reticulation anteriorly, apparently without sculpture posteriorly; dark brown; legs yellowish brown, the femora and tibiae in part somewhat darker.

*Type locality*.—Washington, D. C.

One specimen collected May 20, 1915, by the author.

*Type*.—U.S.N.M. No. 57773.

(2) *TRIMORUS UTAHENSIS* (Ashmead)

*Prosacantha utahensis* ASHMEAD, U. S. Nat. Mus. Bull. 45, p. 189, 1893 (female).—BRUES, *Genera insectorum*, fasc. 80, p. 23, 1908.

*Hoplogryon utahensis*, KIEFFER, *Genera insectorum*, fasc. 80B, p. 95, 1910; Das Tierreich, vol. 48, p. 229, 1926.

*Type locality*.—Park City, Utah.

*Type*.—U.S.N.M. No. 24498.

(3) *TRIMORUS FORMOSUS*, new species

*Female*.—Length 1.27 mm. Head about twice as wide as long, nearly 1.3 times as wide as the thorax, not quite so wide as the abdomen; occiput with dense impressed reticulation; vertex finely reticulate; frons without sculpture except some indistinct markings above, with a fine suture from antennae to anterior ocellus; mesonotum, scutellum laterally, second tergite laterally, third tergite laterally and posteriorly, and following tergites with short white pubescence; mesonotum roughly scaly reticulate; parapsidal grooves present on posterior half of mesonotum; scutellum smooth, somewhat roughened anteriorly; spine on metanotum rather short, acute; abdomen 1.7 times as long as wide, 1.9 times as long as the thorax; petiole slightly wider than long, with 8 or 9 longitudinal grooves extending its entire length (except for the very narrow anterior and posterior margins); second tergite 1.4 times as wide as long, one and one-third times as long as the petiole, with 9 or 10 deep grooves separated by narrow ridges to posterior third; third tergite 1.2 times as wide as long, 2.6 times as long as the second, smooth, without sculpture, anterior wings extending nearly to the middle of the third tergite, about four times as long as wide; black; legs brown, the front and middle tibiae darker in part.

*Type locality*.—Chilliwack, British Columbia.

*Type*.—U.S.N.M. No. 57774.

One specimen collected June 5, 1927, by Oscar Whittaker.

(4) *TRIMORUS BRUESI* (Kieffer)

*Prosacantha brachyptera* ASHMEAD, Can. Ent., vol. 20, p. 50, 1888 (female).

*Hoplogryon bacypterus*, ASHMEAD, U. S. Nat. Mus. Bull. 45, p. 204, 1893 (female).—

HARRINGTON, Trans. Roy. Soc. Canada, ser. 2, sect. 4, p. 185, 1899 (male).—

BRUES, Genera insectorum, fasc. 80, p. 25, 1908.—FOUTS, Cornell Univ. Mem. 101, p. 964, 1928.

*Hoplogryon bruesi* KIEFFER, General insectorum, fasc. 80B, p. 96, 1910.

*Hoplogryon dolichopterus* KIEFFER, Das Tierreich, Lief. 48, p. 216, 1926 (male, female).

*Female*.—Length 0.95 mm. Head not quite twice as wide as long, a little wider than the thorax, somewhat narrower than the abdomen; frons with a fine median carina to anterior ocellus, with short striae and reticulation below on the sides, laterally and above smooth, indistinctly punctulate; occiput with dense impressed reticulation; cheeks indistinctly aciculate; thorax as wide as long, convex dorsally; mesonotum scaly-reticulate, rather strongly but shortly longitudinally wrinkled posteriorly, with the parapsidal furrows present as broad depressions on posterior half; scutellum convex, reticulate on anterior half, polished posteriorly; metanotal spine triangular, acute at apex, less than half as long as the scutellum; anterior wings about four times as long as wide, with short cilia along margins, extending about to the apex of the third tergite; abdomen 1.3 times as long as wide, convex

dorsally; petiole about twice as wide as long, with a number of longitudinal grooves its entire length, with a slight transverse depression across middle; second tergite one and one-half times as long as the petiole, about 1.8 times as wide as long, with a number of parallel or slightly diverging ridges to posterior third, these ridges subequal in length except near the lateral margins of the segment where they are much shorter; third tergite 2.6 times as long as the second, 1.5 times as wide as long, faintly reticulate, sparsely pubescent laterally and along the posterior margin; body dark brown; antennae dark brown, the scape lighter basally; mandibles yellow, the teeth reddish; legs yellow, the femora, tibiae, and tarsi, in part, somewhat darker; wings tinged with brown.

*Variations*.—Body sometimes black; legs sometimes mostly brownish, but not darkly so; mesonotum in some specimens with the sculpture more delicate, without wrinkles posteriorly, with the parapsidal furrows shorter and shallower; metanotal spine sometimes half as long as the scutellum and sometimes very short, a mere tubercle; in several specimens the ridges on the second tergite are only half as long as the segment and the intervening grooves are deeper; the anterior wings may extend to the apex of the third tergite or scarcely extend past its base.

*Type locality*.—Ottawa, Canada.

*Type*.—U.S.N.M. No. 2244.

The description and notes on variation given above are based on a number of specimens in the author's collection procured from the following localities: Ottawa, Canada (three specimens); McLean, N. Y. (two specimens collected June 21, 1924, from spider material by sifting); McLean Bogs, N. Y. (three specimens, May 16, 1925); Cinnamon Lake, Schuyler County, N. Y. (two specimens, June 5, 1925); Nigger Pond, Oswego County, N. Y. (one specimen, September 3, 1926); Ithaca, N. Y. (one specimen, May 1924); Woodwardia Swamp in Freeville, N. Y. (one specimen, July 28, 1929); and two specimens labeled Wachocastinook Creek, Salisbury, Conn., June 29, 1930. All this New York material was sent to me for identification by Profs. C. R. Crosby and M. D. Leonard, of Cornell University.

(5) **TRIMORUS GRANDIS** (Brues)

*Hoplogryon grandis* BRUES, Bull. Wisconsin Soc. Nat. Hist., ser. 2, vol. 5, p. 102, 1907.—KIEFFER, Das Tierreich, Lief. 48, p. 218, 1926.—FOUTS, Cornell Univ. Mem. 101, p. 964, 1928.

*Type locality*.—Long Island, N. Y.

*Type*.—U.S.N.M. No. 42705.

(6) **TRIMORUS PULCHRICORNIS**, new species

*Female*.—Length 1.9 mm. Head twice as wide as long, one and one-third times as wide as the thorax, as wide as the abdomen; frons

with a median longitudinal carina, stronger below, extending to the anterior ocellus; below and laterally to the summit of the eye the frons is strongly carinate; upper part of frons smooth, with large punctures, these punctures several times their diameter distant from one another; below this punctate area the frons is smooth, and, except for the median carina, without sculpture; vertex separated from the occiput by a subacute ridge; occiput striatopunctate; mesonotum and scutellum umbilicately punctate, the punctures much shallower than wide; posteriorly on the mesonotum the punctures are larger, irregular, and more or less confluent; parapsidal grooves not present; spine of metanotum long, acute, reaching above the middle of the petiole; wings narrow, extending about to the middle of the second tergite, not ciliate; abdomen very little longer than the head and thorax combined, 1.2 times as long as wide, ovate; petiole about one and one-half times as wide as long, with a number of longitudinal grooves separated by low rounded ridges; second tergite likewise with grooves but they are wide and shallow, slightly wider apically than basally, the intervening ridges extending to apical fourth; third tergite about one and two-thirds times as wide as long, three times as long as the second, striatopunctate on basal three-fourths except medially where it is smooth; striae on third tergite irregular, wavy, becoming finer posteriorly; laterally and on a median longitudinal area the third tergite is smooth, punctate but not striate; punctures scattered, large anteriorly on the third tergite, becoming much smaller posteriorly, scattered all over the surface except on a narrow band posteriorly; black; proximal five antennal joints light brownish yellow; legs yellow, the posterior tibiae and tarsi light brownish; thorax reddish brown, the scutellum and a large median spot on the mesonotum black; petiole reddish brown.

*Type locality*.—Glen Echo, Md.

*Type*.—U.S.N.M. No. 57775.

One specimen collected by the author.

This pretty species is apparently closely allied to *grandis* Brues. Its distinctive color pattern enables it to be readily separated from all our described species.

(7) **TRIMORUS CRASELLUS**, new name

*Gryon columbianus* ASHMEAD, U. S. Nat. Mus. Bull. 45, p. 208, 1893 (female).—BRUES, *Genera insectorum*, fasc. 80, p. 25, 1908.

*Paragryon columbianus*, KIEFFER, *Genera insectorum*, fasc. 80B, p. 99, 1910.—BRUES, *Connecticut Geol. Nat. Hist. Surv. Bull.* 22, p. 554, 1916.—KIEFFER, *Das Tierreich*, Lief. 48, p. 237, 1926 (female).

The name *columbianus* is precoccupied in *Trimorus* by *columbianus* Ashmead (described in *Prosacantha* in 1893).



*Female*.—Length 1.36 mm. Head 1.8 times as wide as long, 1.1 times as wide as the thorax; frons striate below middle of eye except for a small area on each side of the median carina, which is polished; median carina present on lower half of frons, replaced by a narrow groove to anterior ocellus; frons above striae reticulate with small dense punctures; vertex densely punctulate; occiput impressed-reticulate; thorax about as wide as long, subconvex above; mesonotum uniformly densely punctulate, with parapsidal grooves on posterior half; scutellum densely punctulate; metanotal spine short, acute; lateral angles of propodeum rather prominent, acute; wings not reaching apex of propodeum; abdomen 1.5 times as long as wide, 1.1 times as wide as the head, strongly convex dorsally; petiole about 1.6 times as wide as long, with ridges to anterior margin, with a trough-shaped depression across middle; second tergite about 2.2 times as wide as long, 1.45 times as long as the petiole, with a few widely spaced grooves on anterior half, all the area between these grooves and posterior to them except a narrow marginal rim rugose; third tergite 1.4 times as wide as long, 2.5 times as long as the second, uniformly closely punctulate; black; antennae piceous, the scape and pedicel reddish brown; coxae dark brown; legs yellow.

*Type locality*.—District of Columbia.

*Type*.—U.S.N.M. No. 2246.

Redescribed from one specimen in the author's collection labeled: Washington, D. C., April 28. It was compared with the type of *Gryon columbianus* in 1926.

(8) **TRIMORUS SOLITARIUS** (Ashmead)

*Hypogryon solitarius* ASHMEAD, U. S. Nat. Mus. Bull. 45, p. 205, 1893.—KIEFFER, Das Tierreich, Lief. 48, p. 215, 1926.

*Type locality*.—Ottawa, Canada.

*Type*.—U.S.N.M. No. 24527.

(9) **TRIMORUS NITIDUS**, new species

*Female*.—Length 1.09 mm. Very closely allied to *exilis* from which it differs as follows: Head 1.8 times as wide as long, 1.2 times as wide as the thorax, strongly convex in front; a very delicate carina to middle of frons; no striae medially below on the frons; no reticulation along inner eye margin; upper third of frons with some very fine, indistinct punctures; pubescence more sparse generally, apparently not present on mesonotum and scutellum; second tergite 1.7 times as long as the petiole; third tergite 1.4 times as wide as long, 2.5 times as long as the second.

*Type locality*.—Hollyburn, British Columbia (September 3, 1929).

*Type*.—U.S.N.M. No. 57776.

*Paratype locality*.—Galiano Island, British Columbia (August 1, 1929).



Two specimens collected by Oscar Whittaker.

In the paratype the pubescence is absent medially on the third tergite. Paratype in Whitaker's collection.

(10) **TRIMORUS EXILIS**, new species

*Female*.—Length 1.27 mm. Head about twice as wide as long, 1.15 times as wide as the thorax, indistinctly narrower than the abdomen; frons with a delicate impressed median line to upper third, with short striae below, with an impressed-reticulate area laterally just above the striae, narrowly reticulate along inner eye margin, finely reticulate on upper third, the impressions less distinct medially; thorax as wide as long, convex above; mesonotum scaly reticulate, the sculpture moderately strong; parapsidal grooves distinct on posterior third; scutellum convex, reticulate, more strongly so anteriorly; mesonotum and scutellum evenly pubescent; propodeum arcuately emarginate posteriorly, the lateral angles sharp; metanotal spine triangular, rather broad basally, acute apically, about half as long as the scutellum; abdomen broadly elliptical, 1.5 times as long as wide, 1.8 times as long as the thorax; petiole twice as wide as long, with numerous narrow deep grooves to anterior margin, the anterior margin narrowly reflexed; second tergite about twice as wide as long, about twice as long as the petiole, with ridges medially to posterior fourth, the ridges becoming progressively shorter laterally, reticulate behind these shorter ridges; third tergite 1.5 times as wide as long, 2.2 times as long as the second, pubescent all over but more sparsely so medially, evenly reticulate, the impressions finer along the lateral margins, with the posterior margin narrowly smooth, without sculpture; wings narrow, not quite attaining the apex of the propodeum; black; legs very dark brown, the trochanters, tibiae proximally and distally, and metatarsi basally, reddish brown.

*Type locality*.—Chilliwack, British Columbia.

*Type*.—U.S.N.M. No. 57777.

One specimen collected September 9, 1927, by Oscar Whittaker.

(11) **TRIMORUS CRASSICEPS**, new species

*Female*.—Length 0.97 mm. Head about one and one-fourth times as wide as long, 1.2 times as wide as the thorax; frons strongly convex, with impressed reticulation and pubescent except medially below, with a median carina to anterior ocellus, this carina not distinct except below where the surface is smooth; vertex and occiput impressed-reticulate like the frons; thorax about as wide as long, somewhat flattened above; parapsidal grooves nearly reaching anterior margin of mesonotum, sharply indicated; mesonotum scaly-reticulate, the sculpture moderately strong; scutellum with dense impressed reticulation, the areas small; metanotal spine very short, blunt apically, about a third the length of the scutellum; wings short, narrow, ex-

tending to apex of propodeum; abdomen 1.45 times as long as wide, slightly wider than the head, strongly convex dorsally; petiole about twice as wide as long, with numerous longitudinal ridges, with a trough-shaped depression across middle; second tergite about twice as wide as long, 1.6 times as long as the petiole, with many parallel or diverging longitudinal ridges which extend medially about to apical fourth; laterally the ridges are shorter; third tergite 1.3 times as wide as long, uniformly reticulate except narrowly laterally and posteriorly; black; scape dark brown, slightly paler proximad; flagellum piceous; legs reddish brown, the coxae, femora, and tibiae brown; posterior tibiae reddish brown; tarsi yellowish, the last joint of each brown.

*Type locality*.—Hollyburn, British Columbia.

*Type*.—U.S.N.M. No. 57778.

One specimen collected June 3, 1930, by Oscar Whittaker.

(12) *TRIMORUS PUNCTITHORAX*, new species

*Female*.—Length 1.5 mm. Head about twice as wide as long, a little wider than the thorax; frons laterally and above reticulate with fine striae and numerous minute punctures; frons with a carina to the anterior ocellus, medially polished, with a few wavy aciculae; except for this median smooth area the frons is closely and evenly pubescent; vertex and occiput with dense impressed reticulation; thorax about as wide as long; mesonotum very densely and finely punctate, closely and evenly pubescent; parapsidal grooves briefly indicated posteriorly; scutellum with close impressed reticulation, pubescent over its entire surface; metanotal spine short, acute, not reaching past the apex of the metanotum; wings narrow, not quite reaching to the apex of the propodeum; abdomen about one and two-thirds times as long as wide, about one and one-fourth times as long as the head and thorax combined, about one and one-tenth times as wide as the head; petiole about one and one-half times as wide as long, with eight of nine longitudinal grooves, slightly depressed across the middle; second tergite 1.6 times as wide as long, one and one-half times as long as the petiole, with ridges and grooves reaching apical one-fourth; the grooves widen apically and those toward the middle of the segment have each a small longitudinal ridge medially at the apex; posterior fourth of the second tergite smooth, without sculpture; following segments evenly and moderately thickly pubescent; third tergite 1.4 times as wide as long, 2.4 times as long as the second, entirely finely reticulate except narrowly along the posterior margin; black; legs dark brown, the knees, tibiae apically, posterior tibiae entirely, and each metatarsus yellowish brown to rather dark reddish brown; coxae black.

*Type locality*.—Chilliwack, British Columbia.

*Type*.—U.S.N.M. No. 57779.

One specimen collected September 18, 1926, by Oscar Whittaker.

(13) *TRIMORUS SUBAPTERUS*, new species

*Female*.—Length 1.53 mm. Head about twice as wide as long, 1.1 times as wide as the thorax; occiput, vertex, frons above and on the sides, mesonotum, and scutellum with a strong granular sculpture; frons medially below smooth, with a carina extending to median ocellus; thorax 1.1 times as long as wide; parapsidal grooves short; spine on metanotum short, acute; wings attaining apex of metanotum, very narrow, the venation not discernible; lateral angles of propodeum projecting, blunt apically; abdomen 1.4 times as long as wide, 1.1 times as wide as the head; petiole 1.5 times as wide as long, with five deep grooves above and a much broader groove on each side; these grooves extend from the anterior margin nearly to the posterior margin, with a trough-shaped depression across middle; second tergite 1.7 times as wide as long, 1.3 times as long as the petiole, with about 10 strong diverging longitudinal ridges to apical fourth; third tergite 1.4 times as wide as long, 2.7 times as long as the second, evenly covered with decumbent white hairs, uniformly, except along the lateral and posterior margins, with dense impressed reticulation; black; extreme apices of femora, tibiae basally (proximal one-third of hind tibiae) and metatarsus of each leg, reddish yellow; tarsi, except as noted above, brown.

*Type locality*.—Chilliwack, British Columbia.

*Type*.—U.S.N.M. No. 57780.

Three specimens collected September 6 and 11, 1926, by Oscar Whittaker.

Paratype in Whittaker collection.

(14) *TRIMORUS RUFOSIGNATUS* (Kieffer)

*Hoplogryon rufipes* ASHMEAD (*non* Thomson, 1859), U. S. Nat. Mus. Bull. 45, p. 205, 1893 (female).—BRUES, *Genera insectorum*, fasc. 80, p. 25, 1908.—FOUTS, Cornell Univ. Univ. Mem. 101, p. 964, 1928.

*Hoplogryon rufosignatus* KIEFFER, *Genera insectorum*, fasc. 80B, p. 97, 1910.

*Hoplogryon ashmeadianus* KIEFFER, *Das Tierreich*, Lief. 48, p. 215, 1926 (female).

*Female*.—Length 1.14 mm. Head about twice as wide as long, 1.2 times as wide as the thorax, sculptured as in *crassiceps*; thorax a little wider than long, subconvex dorsally; mesonotum closely scaly-reticulate, the sculpture rough, subopaque, the surface appearing closely punctulate; parapsidal grooves apparently nearly complete but not clearly defined except posteriorly; metanotal spine very short as in *crassiceps*; abdomen 1.4 times as long as wide, strongly convex dorsally; petiole nearly twice as wide as long, with numerous longitudinal grooves, not elevated anteriorly and without a transverse depression; second tergite not quite twice as wide as long, 1.4 times as long as the petiole, with ridges to apical fourth as in *crassiceps*; third tergite 1.4 times as wide as long, 2.9 times as long as the second, reticulate as in *crassiceps* but the enclosed areas a little smaller; black; scape very dark brown; legs brown, the femora and tibiae a little darker.

*Type locality*.—District of Columbia.

*Type*.—U.S.N.M. No. 24526.

This description is based on one specimen from McLean, N. Y. It was collected by Prof. C. R. Crosby, June 21, 1924, from spider material by sifting. The author's 1928 record of the occurrence of this species in New York was based on this specimen, which was compared with the type of *Hoplogryon rufipes* Ashmead.

(15) **TRIMORUS ROBUSTUS**, new species

*Female*.—Length 1.42 mm. Head twice as wide as long, about one and one-sixth times as wide as the thorax, about half as long as the thorax; occiput, vertex, and upper half of frons with dense impressed reticulation, the latter area with a number of small scattered punctures; median carina not evident above middle of frons; frons narrowly laterally reticulate, with fine wavy aciculae medially, striate below; thorax a little longer than wide; mesonotum and scutellum scaly reticulate, evenly pubescent; parapsidal grooves absent; spine on metanotum sharp and moderately long; wings extending to the apex of the propodeum, very narrow, the venation not discernible; lateral angles of propodeum projecting, subacute; abdomen about one and one-half times as long as wide, a little wider than the head, one and three-fourths times as long as the thorax; petiole 1.45 times as wide as long, with about ten deep grooves extending from the anterior margin to the posterior one-tenth, not elevated anteriorly and without a transverse depression; second tergite 1.7 times as wide as long, 1.7 times as long as the petiole, with a number of deep longitudinal grooves which are shorter toward the lateral margins of the segment, becoming lost in a moderately strong impressed-reticulate sculpture; five of the grooves, each of which is about twice as wide as any on the petiole, extending nearly to the apex of the tergite; third tergite 1.4 times as wide as long, 2.2 times as long as the second, smoothly reticulate, the enclosed areas fairly large, becoming considerably smaller posteriorly; black; knees and anterior tibiae apically, yellowish brown; tarsi brownish.

*Type locality*.—Chilliwack, British Columbia.

*Type*.—U.S.N.M. No. 57781.

Two specimens collected September 26, 1926, and September 9, 1927 by Oscar Whittaker.

Paratype in Whittaker collection.

(16) **TRIMORUS FINITIMUS**, new species

*Female*.—Length 1.18 mm. Head twice as wide as long, a little wider than the thorax, about as wide as the abdomen, moderately convex in front, scarcely excavated behind; upper frons, vertex, and occiput impressed-reticulate; a fine median carina to anterior ocellus; frons narrowly laterally reticulate, below smooth, without sculpture;

thorax 1.2 times as wide as long, strongly convex above; parapsidal grooves on posterior half of mesonotum; mesonotum with fine scaly reticulation, thickly pubescent, shining; scutellum smooth, with indistinct sculpture, pubescent; metanotal spine about half as long as the scutellum, triangular seen from above, acute apically; abdomen 1.4 times as long as wide, ovate, rounded posteriorly; petiole 1.7 times as wide as long, with numerous longitudinal ridges extending its entire length, with a narrow depressed rim along the anterior margin, without a depression across the middle; second tergite twice as wide as long, 1.6 times as long as the petiole, with a few parallel or slightly diverging ridges medially to posterior fourth; ridges are present laterally but become progressively shorter toward the margin; second tergite reticulate laterally behind the ridges; third tergite 1.5 times as wide as long, 2.4 times as long as the second, evenly pubescent, smoothly reticulate, shining; wings short, extending to the apex of the propodeum; black; legs dark brown, the tarsi and the tibiae proximally reddish brown; last joint of each tarsus dark brown.

*Type locality*.—Chilliwack, British Columbia.

*Type*.—U.S.N.M. No. 57782.

Two specimens collected by Oscar Whittaker on April 23 and May 20, 1926.

Paratype in Oscar Whittaker collection.

(17) *TRIMORUS PALLIDIPE* (Ashmead)

*Xenomerus pallidipes* ASHMEAD, U. S. Nat. Mus. Bull. 45, p. 184, 1893 (female).—Brues, *Genera insectorum*, fasc. 80, p. 22, 1908.

*Trimorus pallidipes* KIEFFER, André, *Spécies des hyménoptères d'Europe et d'Algérie*, vol. 11, p. 110, 1912.—KIEFFER, *Das Tierreich*, Lief. 48, p. 180, 1926 (female).

*Female*.—Antennae, except three proximal joints of one, are lost. Mesonotum striatopunctate, rugose anteriorly. Scutellum smooth, flattened, slightly roughened at anterior margin. Parapsidal grooves distinct, complete.

*Type locality*.—Arlington, Va.

*Type*.—U.S.N.M. No. 24493.

Ashmead's type was examined by the author in 1927 and the preceding brief description made of it.

(18) *TRIMORUS STRIOPUNCTATUS*, new species

*Female*.—Length 2.36 mm. Head about twice as wide as long, about as wide as the thorax, arcuately concave posteriorly; frons smooth, without a median carina, without sculpture on upper half except some small scattered punctures; below the frons is strongly carinate except for a narrow median area, the carinae extending narrowly laterally to top of eye; occiput finely reticulate, aciculate medially; cheeks finely striate; thorax about as wide as long, moder-

ately convex above; mesonotum rather thickly covered with punctures on anterior half, not rugose in this area; on posterior half strongly, more or less irregularly, longitudinally striate; parapsidal grooves perceptible but not sharply defined, difficult to distinguish posteriorly in the coarse striation; scutellum strongly reticulate, high ridges separating the enclosed areas; metanotal spine about half as long as the scutellum, broad and shelf-like; lateral angles of propodeum projecting somewhat, subacute apically; abdomen 1.6 times as long as wide, a little wider than the thorax; petiole 1.2 times as wide as long, with about ten straight longitudinal ridges, without a transverse depression, but with the anterior rim slightly reflexed; second tergite 1.7 times as wide as long, scarcely longer than the petiole, with numerous longitudinal ridges as on the petiole, these ridges, however, diverging, lower and more widely separated than on the petiole; surfaces between these flat, without sculpture; third tergite 1.3 times as wide as long, with numerous somewhat irregular low longitudinal ridges, the intervals between these ridges punctate or with an irregular sculpture; medially on the third tergite the longitudinal ridges are obsolescent on posterior half; posterior margin of third tergite smooth, without sculpture; third and fourth sternites punctate; following tergites with dense, impressed reticulation, the fourth and fifth with several transverse rows of large punctures; black; scape at extreme base, mandibles, except the teeth, all legs, except the coxae, bright yellowish brown; wings tinged with brown.

*Male*.—Length 2.07 mm. Similar generally to the female from which it differs as follows: Head slightly narrower than the thorax; punctures on upper half of frons very few, inconspicuous; carinae laterally on the frons more numerous, continuous above with those on the cheeks; punctures anteriorly on the mesonotum smaller than in the female, the intervals between them greater than in the female; abdomen 1.7 times as long as wide, oval; second tergite about twice as wide as long; third tergite nearly one and one-half times as wide as long, a little more strongly sculptured than in the female, the low irregular ridges present over the whole surface (except a narrow area along the lateral margin); antenna about 0.8 the length of the entire body, filiform, the joints becoming narrower toward the apex; third joint a little over twice as long as wide; fourth joint about twice as long as wide; last joint about as long as the third, three times as long as wide, rounded apically; color as in the female except that the scape is not distinctly lighter colored proximad and that the legs, except the tarsi, are dark reddish brown.

*Type locality*.—Glen Echo, Md.

*Other locality*.—Mount Holly Springs, Pa.

*Type and allotype*.—U. S. N. M. No. 57783.

Three females and two males collected by the author. The Glen



Echo specimens bear the dates July 1926 and August 12, 1916. The Mount Holly Springs specimen was swept from wheat stubble on May 17, 1920.

*Variation*.—One of the two females from Glen Echo is 1.84 mm. long, the punctures on the frons are, as in the male, few and inconspicuous, and the sculpture on the third tergite is somewhat finer than in the type.

(19) **TRIMORUS ERYTHROGASTER**, new species

*Male*.—Length 1.65 mm. Head 2.1 times as wide as long, a little wider than the thorax, as wide as the abdomen; frons striate below and laterally to the vertex, with a few small scattered punctures above, without a median carina, otherwise smooth, without sculpture; vertex and occiput smooth, unsculptured; cheeks with a few fine striae; scape nearly twice as long as the third joint, about five times as long as the pedicel; pedicel as wide as long, a little thicker than third joint; third joint about three times as long as thick, as long as the fourth, fifth, or sixth, but a little thicker than any one of these joints; joints beyond the sixth missing; thorax 1.1 times as long as wide, convex dorsally; mesonotum very coarsely and thickly punctate anteriorly, smoother and with the punctures more widely separated on posterior half; along the posterior margin the punctures are close together but not so deep as those on the front half of the mesonotum; parapsidal grooves complete; scutellum smooth, with a few small scattered punctures; metanotal spine very sharp at apex, broadened basally, about half as long as the scutellum; wings faintly brownish, extending slightly less than a fourth the length of the abdomen past the latter's apex; abdomen 1.6 times as long as wide, broadly rounded posteriorly; petiole scarcely longer than wide, with numerous longitudinal ridges its entire length, with a broad trough-shaped depression across anterior third; second tergite 1.45 times as wide as long, as long as the petiole, with many slightly diverging ridges all of which extend to posterior fifth; third tergite 1.8 times as wide as long, nearly twice as long as the second, its whole surface covered with small punctures, these punctures thicker laterally; head black; thorax black above, reddish laterally and below; scape reddish brown, a little darker toward apex; petiole and second tergite reddish, the rest of the abdomen dark reddish brown; legs yellowish brown.

*Type locality*.—Arlington, Va.

*Type*.—U.S.N.M. No. 57784.

One specimen collected by the author.

(20) **TRIMORUS SULCATUS** (Kieffer)

*Hoplogryon sulcatus* KIEFFER, Ark. Zool., vol. 1, p. 538, 1904 (male).

*Trimorus sulcatus*, KIEFFER, Das Tierreich, Lief. 48, p. 179, 1926.



*Type locality*.—Texas.

*Type*.—In Kieffer's collection.

(21) **TRIMORUS ERYTHROPUS** (Ashmead)

*Prosacantha erythropus* ASHMEAD, U. S. Nat. Mus. Bull. 45, p. 195, 1893 (female).  
*Hoplogryon erythropus*, KIEFFER, Das Tierreich, Lief. 48, p. 226, 1926.

*Type locality*.—District of Columbia.

*Type*.—U.S.N.M. No. 24511.

Described from two specimens.

(22) **TRIMORUS CROSBYI**, new species

*Female*.—Length 2.0 mm. Head about 1.9 times as wide as long, slightly wider than the thorax; frons without a median carina except just above antennae; frons immediately above bases of antennae and laterally nearly to summits of eyes, and the genae, strongly striate; medially the frons is smooth, without sculpture; upper part of frons sparsely covered with small punctures, otherwise without sculpture; occiput and genae posteriorly aciculate; scape about 1.3 times as long as the club, 1.12 times as long as the joints between scape and club combined; thorax scarcely longer than wide, as wide as the abdomen; mesonotum thickly pubescent, with a rather strong, somewhat irregular reticulation; the intervals between the areas are raised lines so that the areas themselves appear as small, shallow depressions; parapsidal grooves appearing as irregular punctate and roughened lines to about the middle of the mesonotum; scutellum smooth, pubescent laterally and on anterior half, sparsely punctate on anterior half; spine on metanotum rather broad basally, sharp apically, reaching a little beyond the base of the petiole; posterior angles of propodeum about as long as the metanotal spine, acute at apices; abdomen about 1.3 times as long as the head and thorax combined, about 1.8 times as long as wide, ovate; petiole traversed longitudinally by a number of rather broad grooves which are separated one from another by rounded ridges; dorsal surface of the petiole not elevated anteriorly and without a transverse depression; second tergite with seven longitudinal grooves as on the petiole but these grooves wider, extending about to apical fifth of the segment, each on posterior half traversed longitudinally by a ridge (fig. 14); posterior to the grooves and ridges the second tergite is smooth, without sculpture; third tergite traversed longitudinally by grooves on anterior half; these grooves are not like those on the petiole and second tergite but are about half as wide as on those segments and narrow to sharp points apically; the intervals between the grooves are flattened, not so convex; toward the middle of the segment the grooves become shallower as well as narrower and the intervals merge with the flat smooth surface posterior to them; laterally the third tergite is smooth, without sculpture except for a

few small setigerous punctures; except as noted the third tergite is smooth, without sculpture; wings faintly brownish, extending to the apex of the abdomen; black, scape at extreme base, mandibles, and legs for the most part, stramineous; front coxae, hind coxae posteriorly, femora and tibiae outwardly, and last joint of each tarsus brown.

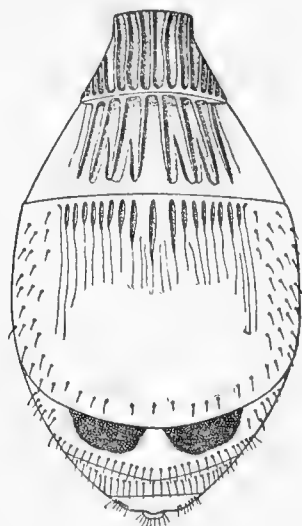


FIGURE 14.—*Trimorus crosbyi*, new species: Dorsal view of abdomen. The granulated areas on the fourth tergite show up somewhat more clearly in the drawing than they do on the type specimen.

*Type locality*.—Wolcott, N. Y.

*Type*.—U.S.N.M. No. 57785.

One specimen collected by Prof. C. R. Crosby on May 23, 1923. It gives me great pleasure to name this species after the late Professor Crosby. This is but one of the many interesting new species that he collected and sent to me for study.

(23) **TRIMORUS DISTINCTUS**, new species

*Male*.—Length 1.80 mm. Head a little less than twice as wide as long, as wide as the thorax, 1.1 times as wide as the abdomen, sub-convex anteriorly, emarginate posteriorly; frons striate on lower half and laterally to top of eye, with a few small scattered punctures, with a median carina on lower half; vertex impressed-reticulate laterally; occiput striate; cheeks reticulate along eye margin, striate otherwise; antennae about 0.9 the length of the entire body; scape a little thicker than joints 3, 4, or 5, the latter subequal in thickness; third joint 2.5 times as long as thick, fourth joint 2.8 times as long as thick; fifth joint about twice as long as thick, obliquely excised on basal half; following joints subequal in thickness and length, about twice as long as thick; last joint about three times as long as thick, pointed at apex; thorax a little longer than wide, convex dorsally; mesonotum reticulate, transversely wrinkled anteriorly, with numerous rather small shallow punctures except where wrinkled; parapsidal grooves complete;

scutellum convex, with several small punctures along anterior margin, otherwise smooth, without sculpture; metanotal spine triangular, broad basally, acute apically, about half as long as the scutellum; wings hyaline, extending a little less than one-fourth the length of the abdomen past the latter's apex; abdomen 1.9 times as long as wide, a little longer than the head and thorax combined, long-ovate, broadly rounded posteriorly; petiole a little longer than wide, with a number of longitudinal ridges its entire length, with a transverse trough-shaped depression at anterior third; second tergite 1.5 times as wide as long, 1.2 times as long as the petiole, with numerous parallel or slightly diverging ridges extending nearly to the apex; third tergite 1.4 times as wide as long, sparsely pubescent laterally, striate on anterior half, the striae becoming finer as they approach the middle; third tergite, except as noted, is smooth, without sculpture; third sternite with a few small scattered punctures; black; coxae very dark brown; legs reddish brown, the femora and tibiae darker.

*Type locality*.—Brownwood, Tex.

*Type*.—U.S.N.M. No. 57786.

One specimen collected in May 1924 by the author.

(24) **TRIMORUS PERCURRENS**, new species

*Male*.—Length 1.78 mm. Head about twice as wide as long, about as wide as the thorax, indistinctly narrower than the abdomen; occiput impressed reticulate; vertex smooth, without sculpture; frons mostly smooth, with a rather strong median carina to anterior ocellus; a number of smaller carinae from this large one just above the antennae; laterally, nearly to the summits of the eyes, the frons is strongly striate; antennae filiform, about 1.1 times as long as the body; scape a little wider than the other joints; following joints becoming gradually narrower toward the apex of the antenna; scape a little shorter than joints 3 and 4 together; pedicel about as wide as long; third joint about three times as long as wide; following joints subequal in length, a little longer than the third, becoming gradually narrower; last joint about five times as long as thick; all joints, except the scape, thickly covered with short hairs; thorax 1.1 times as long as wide, convex dorsally and evenly covered above with whitish hairs; mesonotum very finely reticulate, more strongly so anteriorly; parapsidal grooves complete, narrow, sharply indicated, of equal width throughout; scutellum convex, smooth, without sculpture; spine on metanotum moderately long, acute at apex; wings hyaline, extending about a third the length of the abdomen past the latter's apex; abdomen 1.64 times as long as wide, a little more than one and one-half times as long as the thorax; petiole 1.36 times as wide as long, with a number of longitudinal grooves extending very nearly to the margins, with a

transverse depression just before the middle; second tergite 1.3 times as wide as long, 1.55 times as long as the petiole, with a number of longitudinal ridges, those near the middle shorter than those next to them on either side, extending from base to middle of segment; the longer ridges reach the posterior third; all these ridges diverge from one another, that is, the intervening grooves widen posteriorly; third tergite 1.4 times as wide as long, twice as long as the second, wavy-striate and reticulate on basal half, the markings very faint near the middle of the segment; third tergite otherwise smooth, without sculpture, without pubescence except a few white hairs laterally; black; legs dark brown to black, the knees and anterior tibiae apically brownish.

*Type locality*.—Hollyburn, British Columbia.

*Type*.—U.S.N.M. No. 57787.

One specimen collected June 11, 1928, by Oscar Whittaker.

(25) **TRIMORUS MINUTUS**, new species

*Female*.—Length 1.14 mm. Head about twice as wide as long, as wide as the thorax, indistinctly narrower than the abdomen; frons, except a small spot on each side at malar space which is impressed reticulate, and vertex, polished, without sculpture; frons with a very fine median carina its entire length; occiput impressed-reticulate; eyes pubescent; thorax about as wide as long; mesonotum shining, with a fine indistinct reticulate sculpture; parapsidal grooves complete, just as in *improcerus*, not finely and sharply indicated as in *percurrrens* but easily distinguished nevertheless; scutellum convex, reticulate basally, smooth apically, with sparse pubescence laterally; metanotal spine moderate in length, acute apically; wings extending a little less than one-third the length of the abdomen past the latter's apex; abdomen one and one-half times as long as wide, hardly wider than the thorax; petiole 1.7 times as wide as long, with a few deep longitudinal grooves dorsally, not elevated anteriorly or depressed transversely; second tergite 1.5 times as wide as long, 1.25 times as long as the petiole, the ridges on basal four-fifths sharp, parallel, the median ones bifurcate apically; third tergite 1.3 times as wide as long, 2.7 times as long as the second, smooth, with extremely faint wavy-reticulate sculpture, pubescent laterally; black; antennae dark brown, the scape yellowish toward base; wings brownish; legs yellowish brown, the swollen parts of femora and tibiae darker; petiole and base of second segment reddish yellow.

*Type locality*.—Glen Echo, Md.

*Type*.—U.S.N.M. No. 57788.

Two specimens collected April 16 and April 23, 1918, by the author. Paratype in Whittaker collection.

(26) *TRIMORUS TENUICORNIS* (Kieffer)

*Hoplogryon tenuicornis* KIEFFER, Berliner Ent. Zeitschr., vol 50, p. 263, 1905 (male).—BRUES, Bull. Wisconsin Nat. Hist. Soc., vol. 7, p. 121, 1909.  
*Trimorus tenuicornis*, KIEFFER, Das Tierreich, Lief. 48, p. 180, 1926.

*Type locality*.—San Mateo, Calif.

*Other locality*.—Orcas Island, Wash. (Brues).

*Type*.—In Kieffer collection.

(27) *TRIMORUS LIONOTUS*, new species

*Male*.—Length 1.71 mm. Head 1.8 times as wide as long, a little wider than the thorax, as wide as the abdomen; frons striate shortly below and on the sides to above middle of eye, with a fine carina to anterior ocellus, with several short striae below anterior ocellus, otherwise without sculpture; occiput impressed-reticulate, smooth posteriorly; cheeks faintly reticulate; antennae elongate, filiform, 1.3 times as long as the body, the joints becoming gradually thinner toward apex; scape about five times as long as thick, about five times as long as the pedicel, the latter scarcely longer than thick; scape 1.7 times as long as joint 3, 1.4 times as long as the terminal joint; joint 3 four times as long as thick, the following joints subequal in length, the last one a little longer; thorax 1.2 times as long as wide, convex dorsally; mesonotum finely reticulate, the areas very small, finely and rather closely punctate, with some small transversely directed wrinkles anteriorly, shortly striate posteriorly; parapsidal grooves complete; scutellum smooth, without sculpture except a few very minute punctures on anterior half; metanotal spine narrow, not widened basally, acute apically, about half as long as the scutellum; lateral angles of propodeum projecting a little, blunt apically; wings about three times as long as wide, projecting a little more than a third of the length of the abdomen past the latter's apex; abdomen 1.65 times as long as wide, ovate, broadly rounded apically; petiole 1.45 times as wide as long, with deep grooves to front margin, slightly depressed across anterior third; second tergite 1.2 times as wide as long, 1.6 times as long as the petiole, with numerous slightly diverging ridges which extend medially to posterior third; these ridges shorter toward the sides of the segment; except for the ridges the second tergite is without sculpture; third tergite 1.35 times as wide as long, twice as long as the second, pubescent laterally and narrowly posteriorly, without sculpture of any kind; following tergites smooth, without sculpture; black; scape, anterior and middle tibiae except at both ends, and all tarsi, except first joint of each, fuscous; coxae black; femora dark brown; tibiae proximally and distally and metatarsi yellowish brown; wings hyaline.

*Type locality*.—Hollyburn, British Columbia.

*Type*.—U.S.N.M. No. 57789.

One specimen collected on September 9, 1929, by Oscar Whittaker. This species may possibly be the opposite sex of *pictus*.

(28) *TRIMORUS PICTUS*, new species

*Female*.—Length 1.73 mm. Head twice as wide as long, 1.2 times as wide as the thorax, 0.93 times as wide as the abdomen; vertex and occiput with dense impressed reticulation, a little roughened medially; frons superiorly irregularly striatopunctate, pubescent, with a median carina to anterior ocellus, polished medially below; thorax about as wide as long; mesonotum roughened, scaly-punctate, the sculpture somewhat stronger posteriorly; parapsidal grooves complete but somewhat irregular anteriorly; scutellum rather thickly pubescent, scaly-punctate anteriorly; metanotal spine short, acute at apex, its upper surface excavated; wings pale fuscous, extending very little past the apex of the abdomen; petiole 1.55 times as wide as long, with a number of deep longitudinal grooves, with a slight constriction just before the middle; second tergite 1.35 times as wide as long, 1.55 times as long as the petiole, with a number of deep grooves which extend medially to apical third; the ridges dividing these grooves are parallel or diverge slightly posteriorly; third tergite 1.45 times as wide as long, 2.2 times as long as the second, smooth, without sculpture; abdomen finely pubescent except a broad median area from base to middle of the third tergite; black; legs reddish brown (except black coxae), the anterior femora, tibiae, and apical joints of all tarsi darker.

*Type locality*.—Hollyburn, British Columbia.

*Type*.—U.S.N.M. No. 57790.

Two specimens collected August 28, 1929 (paratype), and August 27, 1930, by Oscar Whittaker.

Paratype in Whittaker collection.

This species may be the opposite sex of *lionotus*. Although showing differences I would not hesitate to consider specific if they belonged to the same sex, their general appearance which is very similar, their similarity in size, and the identical sculpture of the petiole and second tergite make me doubtful whether they are really distinct.

(29) *TRIMORUS IMPROCERUS*, new species

*Female*.—Length 0.95 mm. Head about twice as wide as long, slightly wider than the thorax, about as wide as the abdomen; occiput finely reticulate; vertex and frons smooth, without sculpture except for a fine median carina on the frons, this carina stronger toward the bases of the antennae, gradually vanishing toward the anterior ocellus; mesonotum pubescent, with a very fine scaly-reticulate sculpture; parapsidal grooves complete, faint anteriorly, deeper and broader posteriorly; scutellum polished, without distinct sculpture; spine on metanotum short, triangular, acute apically; wings extending a third



the length of the abdomen past the latter's apex; thorax a little longer than wide; abdomen about one and three-fourths times as long as wide, convex dorsally; petiole about as long as wide, with a number of longitudinal grooves its entire length, with a transverse depression medially; second tergite 1.2 times as wide as long, 1.25 times as long as the petiole, with a number of diverging longitudinal ridges on basal two-thirds; third tergite not quite 1.3 times as wide as long, 2.2 times as long as the second, smooth, without sculpture, with the pubescence very fine, present only laterally; black; wings faint brownish; legs dark brown, the anterior tibiae at apices, other tibiae proximally, and all tarsi yellowish.

*Type locality*.—Chilliwack, British Columbia.

*Type*.—U.S.N.M. No. 57791.

One specimen collected September 24, 1926, by Oscar Whittaker.

(30) *TRIMORUS NOTABILIS*, new species

*Female*.—Length 1.1 mm. Head as wide as the thorax; frons striate below, without sculpture otherwise except a delicate carina to anterior ocellus; in front of the ocellus this carina is extremely fine; thorax about as wide as long, as wide as the abdomen; mesonotum with sculpture similar to but stronger than that in *improcerus*; scutellum polished, without pubescence, with a few small punctures anteriorly; metanotal spine very short, acute; posterior angles of propodeum rounded; petiole about one and one-third times as wide as long, with longitudinal ridges separated by deep grooves; second tergite one and one-third times as wide as and one and two-fifths times as long as the petiole, with slightly diverging ridges nearly to apex; third tergite 1.4 times as wide as long, 2.5 times as long as the second, without sculpture of any kind; following tergites likewise without sculpture; front wing extending about half the length of the abdomen past the latter's apex; black; trochanters, and tarsi basally, brownish; wings faintly brownish.

*Type locality*.—Chilliwack, British Columbia.

*Type*.—U.S.N.M. No. 57792.

Two specimens collected May 9 and May 24, 1926, by Oscar Whittaker.

Paratype in Whittaker collection.

(31) *TRIMORUS VARIUS*, new species

*Male*.—Length 2.18 mm. Head twice as wide as long, about as wide as the thorax, indistinctly wider than the abdomen; frons striate below and on the sides, the striae continuous with those on the cheeks, with a median carina to anterior ocellus, and with a few scattered punctures above; frons, except as noted, smooth, without sculpture; occiput rather finely and irregularly striate; antennae 1.45 times as



long as the body, filiform, the joints becoming gradually thinner toward the apex; scape four times as long as thick, five times as long as the pedicel, 1.4 times as long as the third joint, 1.2 times as long as the fourth, 1.1 times as long as the fifth, 1.2 times as long as the twelfth; fifth joint 1.2 times as long as the eleventh; last joint about seven times as long as thick, acuminate; thorax 1.1 times as long as wide, strongly convex above; mesonotum thickly covered with large punctures which are less than their diameter apart, with a few wrinkles anteriorly; laterally the punctures are larger, forming a coarse reticulation; parapsidal grooves present as short deep grooves; scutellum coarsely reticulate anteriorly, smooth and polished posteriorly; metanotal spine acuminate, gradually narrowed toward base, about as long as the scutellum, extending at right angle to the surface of the propodeum; lateral angles of propodeum prominent, subacute; wings three times as long as wide, hyaline, extending half the length of the abdomen past the latter's apex; abdomen ovate, broadly rounded posteriorly, 1.8 times as long as wide; petiole 1.2 times as long as wide, with numerous longitudinal ridges which extend only part way up on the broadly reflexed anterior margin; second tergite 1.2 times as wide as long, scarcely longer than the petiole, with many slightly diverging ridges of equal length extending to apical fifth; third tergite 1.4 times as wide as long, 1.8 times as long as the second, strongly striate medially on basal half, less strongly striate laterally on basal half, with a few scattered punctures, those toward the front somewhat larger and deeper; the striae really extend a little way past the middle of the third tergite but they are, beyond this point, shallow, not sharply indicated; a broad area along the lateral margin is sparsely punctate, without striae; scape and pedicel yellowish brown; mandibles red; thorax reddish, the scutellum and the mesonotum (except laterally and posteriorly) black; mesopleuron above and metapleuron mostly black; abdomen black, the petiole and base of second tergite red; legs entirely light yellowish brown.

*Type locality*.—Cabin John, Md.

*Type*.—U.S.N.M. No. 57793.

One specimen collected July 30, 1924, by the author.

(32) *TRIMORUS MARYLANDICUS* (Ashmead)

*Prosacantha marylandica* ASHMEAD, U. S. Nat. Mus. Bull. 45, p. 193, 1893.—

BRUES, *Genera insectorum*, fasc. 80, p. 22, 1908; Connecticut Nat. Hist. Surv. Bull. 22, p. 552, 1916.

*Hoplogryon marylandicus*, KIEFFER, *Genera insectorum*, fasc. 80B, p. 95, 1910; Das Tierreich, Lief. 48, p. 232, 1926.

*Female*.—Length 2.41 mm. Head as wide as the thorax; frons with a fine median carina to anterior ocellus; lower half of frons polished, impunctate, upper half with numerous, moderately large, shallow

punctures; frons laterally striate to top of eye; occipute shining, indistinctly transversely aciculate; thorax scarcely longer than wide, as wide as the abdomen; mesonotum coarsely punctate, the punctures arranged in more or less distinct rows posteriorly; scutellum punctate like the anterior part of the mesonotum, with a small median polished area posteriorly; metanotal spine long, acute at apex, broad basally; abdomen 1.8 times as long as wide; petiole about as long as wide, with numerous longitudinal ridges extending the entire length of the segment, without a transverse depression, and without the anterior margin reflexed; second tergite about one and one-fourth times as long as the petiole, slightly wider than long, with numerous parallel or slightly diverging ridges which nearly reach the apex; all of these ridges extend equally far posteriorly, leaving a narrow polished border behind them; third tergite 1.4 times as wide as long, twice as long as the second, strongly striate medially, the striae extending nearly to the apex, on lateral third irregularly striate with large scattered punctures; a row of small setigerous punctures limits the extension of the striae posteriorly; fourth tergite punctate, reticulate anteriorly; wings reaching the tip of the abdomen; black; scape brown proximad, fuscous on distal two-thirds; pedicel fuscous, brown at extreme apex; mandibles and legs reddish brown.

*Type locality*.—Oakland, Md.

*Type*.—U.S.N.M. No. 24505.

*Other localities*.—Washington, D. C., and Cabin John, Md.

Species redescribed from two female specimens collected by the author at Washington, June 25, 1920, and Cabin John, Md., July 14, 1917. The Washington specimen was collected in a low, rather swampy place in the Soldiers' Home Park. Both specimens were compared with the type in the National Museum.

(33) *TRIMORUS STRIATIFRONS* (Ashmead)

*Prosacantha striatifrons* ASHMEAD, U. S. Nat. Mus. Bull. 45, p. 188, 1893.

*Hoplogryon striatifrons*, KIEFFER, Das Tierreich, Lief. 48, p. 225, 1926.

*Type locality*.—Jacksonville, Fla.

*Type*.—U.S.N.M. No. 24496.

Originally described from one specimen.

(34) *TRIMORUS RUBRIPES RUBRIPES*, new species and variety

*Male*.—Length 3.25 mm. Head about as wide as the thorax, a little wider than the abdomen, entirely, except the interocellar area and a small area to the side of each lateral ocellus, covered with strong carinae; frons with a strong median carina extending to the anterior ocellus; antenna slender, threadlike, the joints very gradually narrowing toward the apex of the antenna; scape slightly longer than joints 2 and 3 combined, about five times as long as thick;

third joint about four times as long as thick, a little more than one and one-tenth times as long as the fourth, about one and one-fourth times as long as the fifth; fifth joint about three times as long as thick, the oblique excision reaching nearly to the basal two-fifths of the joint; following joints becoming gradually thinner; last joint about five times as long as thick, acute at apex, a little shorter than the third; mesonotum strongly confluent punctate anteriorly, shallowly umbilicately punctate medially, rugosostriate posteriorly; parapsidal grooves briefly, indistinctly indicated posteriorly; scutellum shallowly umbilicately punctate (like the mesonotum medially); spine of metanotum long, acute, extending as far posteriorly as the base of the petiole; wings brownish, extending a little past the apex of the abdomen; abdomen about one and two-fifths times as long as the head and thorax combined, about two and two-fifths times as long as wide, seen from above elongate ovate in shape; petiole a little less than one and one-half times as long as wide, with strong longitudinal carinae from base to apex; second tergite one and three-tenths times as long as wide, as wide as the petiole is long, carinate like the petiole; third tergite one and one-fourth times as wide as long, one and two-fifths times as long as the second, carinate like the first and second tergites nearly to the apex, the median carinae not quite as long as those to either side; laterally the tergite has a few small punctures; third tergite rather sparsely pubescent laterally; following tergites with fine impressed reticulation except along the posterior margin of each one, all of them with long white hairs, thicker laterally; third sternite strongly striate; black; scape on proximal half dark rufous; coxae black except at apices where they are reddish brown; legs, except the terminal joint of each tarsus which is fuscous, reddish brown; mandibles yellowish brown, the tips reddish.

*Type locality*.—Glen Echo, Md.

*Type*.—U.S.N.M. No. 57794.

Three specimens collected by the author on June 5, 1921 (type), and April 25, 1926.

Paratype in Whittaker collection.

*Variation*.—The two paratypes have the scape dark reddish only at extreme base.

TRIMORUS RUBRIPES RUFOCOXALIS, new variety

*Male*.—Length 3.67 mm. Similar to var. *rubripes* except as follows: Scape black except at extreme base where it is dark reddish; coxae reddish brown like the rest of the legs; posterior coxae darker at bases; all carinae on the third tergite equally long.

*Type locality*.—Glen Echo, Md.

*Type*.—U.S.N.M. No. 57795.

One specimen collected by the author.

(35) **TRIMORUS KANSASENSIS** (Gahan)

*Hoplogryon kansagensis* GAHAN, Proc. Ent. Soc. Washington, vol. 14, p. 7, 1912 (female); U. S. Dept. Agr. Misc. Publ. 174, p. 146, 1933.

*Type locality*.—Manhattan, Kans.

*Type*.—U.S.N.M. No. 14354.

This species was described from a specimen obtained from a cage in which experiments with the Hessian fly were being carried on, and Mr. Gahan says in his original description that it is "possibly, though not likely, a parasite of the fly."

(36) **TRIMORUS STRIATIVENTRIS** (Ashmead)

*Prosacantha striativentris* ASHMEAD, U. S. Nat. Mus. Bull. 45, p. 197, 1893 (male).  
*Hoplogryon striativentris*, KIEFFER, Das Tierreich, Lief. 48, p. 225, 1926.

*Type locality*.—District of Columbia.

*Type*.—U.S.N.M. No. 24517.

Described from one collected specimen.

(37) **TRIMORUS REPENTINUS**, new species

*Female*.—Length 0.95 mm. Head 1.8 times as wide as long, 1.2 times as wide as the thorax, scarcely wider than the abdomen, subconvex anteriorly: frons shortly striate below on the sides, with a fine median carina on lower half, otherwise without sculpture, smooth; vertex smooth, without sculpture; occiput impressed-reticulate; cheeks aciculate; thorax a little longer than wide; mesonotum convex, reticulate; parapsidal grooves represented by short broad depressions posteriorly on the mesonotum; metanotal spine very short, a mere tubercle; wings about four times as long as wide, with long cilia on all margins, extending nearly half the length of the abdomen past the latter's apex; abdomen 1.6 times as long as wide, 1.6 times as long as the thorax; petiole 1.5 times as wide as long, with numerous longitudinal ridges extending over the slightly upturned anterior margin to the edge of the segment; second tergite 1.4 times as wide as long, 1.5 times as long as the petiole, with deep parallel grooves to posterior third; the ridges between these grooves are flattened on top and widen posteriorly, merging with the flat polished surface of the segment; third tergite 1.2 times as wide as long, 2.4 times as long as the second, longitudinally striate to apical fifth, the striae becoming finer and wavy posteriorly; dark brown; abdomen reddish brown; legs, including coxae, light yellowish brown; wings hyaline.

*Type locality*.—Cabin John, Md.

*Type*.—U.S.N.M. No. 57796.

Two specimens collected July 31, 1916, and June 30, 1917, by the author.

Paratype in Whittaker collection.

(38) **TRIMORUS BRUNNEIPES**, new species

*Female*.—Length 0.98 mm. Head about twice as long as wide, as wide as the abdomen, distinctly wider than the thorax; frons with a very delicate median carina extending to upper third; lower part of frons and cheeks striate; frons otherwise smooth, without distinct sculpture; occiput finely reticulate; scape, following five joints combined, and club subequal in length; scape about five times as long as thick; mesonotum thickly clothed with short whitish hairs, with a delicate sculpture, not distinctly reticulate or punctate but rather leathery in appearance; parapsidal grooves absent; scutellum sparsely pubescent, smooth, without distinct sculpture; spine on metanotum short, acute at apex; posterior angles of propodeum rounded; wings brownish, extending about one-fourth the length of the abdomen past the latter's apex; petiole twice as wide as long, with about nine longitudinal grooves separated by narrow, sharp ridges; second tergite about one and one-third times as wide as long, about twice as long as the petiole, with about a dozen deep longitudinal grooves on basal two-thirds; these grooves are deep, considerably wider than those on the petiole, and are equally wide throughout their length; apical third of second tergite smooth, without sculpture; third tergite 1.45 times as wide as long, twice as long as the second, with numerous grooves basally which are similar to but narrower than, and not so deep as, those on the second tergite; medially these grooves reach the middle of the segment but they become gradually shorter toward the sides; terminal tergites smooth, without distinct sculpture; black; scape at extreme base brownish; trochanters and tibiae proximad yellowish; legs otherwise brown; petiole dark red.

*Type locality*.—McLean Bogs, N. Y.

*Type*.—U.S.N.M. No. 57797.

One specimen collected May 16, 1925, by M. D. Leonard.

(39) **TRIMORUS PUSILLUS** (Ashmead)

*Prosacantha pusilla* ASHMEAD, U. S. Nat. Mus. Bull. 45, p. 192, 1893 (female).

*Hoplogryon pusillus*, KIEFFER, Das Tierreich, Lief. 48, p. 228, 1926.

*Type locality*.—Jacksonville, Fla.

*Type*.—U.S.N.M. No. 24504.

Described from a single specimen.

(40) **TRIMORUS COLUMBIANUS** (Ashmead)

*Prosacantha columbiana* ASHMEAD, U. S. Nat. Mus. Bull. 45, p. 194, 1893 (female).

*Hoplogryon columbianus*, KIEFFER, Genera insectorum, fasc. 80B, p. 95, 1910;  
Das Tierreich, Lief. 48, p. 226, 1926.

*Type locality*.—District of Columbia.

*Type*.—U.S.N.M. No. 24507.

(41) **TRIMORUS FLAVICOXA** (Ashmead)

*Prosacantha flavicoxa* ASHMEAD, U. S. Nat. Mus. Bull. 45, p. 196, 1893 (female).

*Hoplogryon flavicoxa*, KIEFFER, Genera insectorum, fasc. 80B, p. 95, 1910; Das Tierreich, Lief. 48, p. 231, 1926.

*Type locality*.—Virginia.

*Type*.—U.S.N.M. No. 24512.

Described from a single specimen.

(42) **TRIMORUS XANTHOPUS**, new species

*Female*.—Length 1.43 mm. Head about twice as wide as long, as wide as the thorax, as wide as the abdomen; frons with short striae below, narrowly striate laterally to middle of eyes, with small scattered punctures on upper half, with a fine median carina to anterior ocellus; vertex reticulate; occiput and cheeks smooth, without sculpture; thorax about as wide as long, convex above anteriorly, flattened posteriorly; mesonotum strongly sculptured, coarsely and confluent punctate, the punctures more distinct medially, coarsely reticulate posteriorly, the enclosed areas large; parapsidal grooves briefly indicated posteriorly, not clearly indicated; scutellum roughly sculptured, with large punctures, a median posterior area smooth, polished; metanotal spine triangular in shape, broad basally, acute apically, slightly more than half as long as the scutellum; abdomen 1.75 times as long as wide, convex dorsally; petiole about as long as wide, with numerous longitudinal ridges extending its entire length, not elevated anteriorly and without a transverse depression; second tergite 1.2 times as wide as long, 1.3 times as long as the petiole, with many parallel or slightly diverging ridges extending nearly to the posterior margin of the segment; third tergite 1.3 times as wide as long, 2.2 times as long as the second, striate basally, these striae continued posteriorly as fine wavy aciculations nearly to the apex of the segment; third tergite sparsely pubescent laterally, without pubescence anteriorly and medially; black; scape and pedicel brown, the former somewhat paler basally; legs (including coxae) yellow; wings hyaline.

*Type locality*.—Glen Echo, Md.

*Type*.—U.S.N.M. No. 57798.

One specimen collected September 29, 1917, by the author.

(43) **TRIMORUS FUSCIPENNIS** (Ashmead)

*Prosacantha fuscipennis* ASHMEAD, Ent. Amer., vol. 3, p. 117, 1887 (male); U. S. Nat. Mus. Bull. 45, p. 194, 1893.

*Hoplogryon fuscipennis*, KIEFFER, Genera insectorum, fasc. 80B, p. 95, 1910; Das Tierreich, Lief. 48, p. 225, 1926.

*Type locality*.—Jacksonville, Fla.

*Type*.—U.S.N.M. No. 24506.

(44) *TRIMORUS NIGRIPES* (Ashmead)

*Prosacantha nigripes* ASHMEAD, U. S. Nat. Mus. Bull. 45, p. 188, 1893 (male, female).

*Hoplogryon nigripes*, KIEFFER, Genera insectorum, fasc. 80B, p. 95, 1910; Das Tierreich, Lief. 48, p. 225, 1926.

*Habitat*.—The Dalles and Portland, Oreg.

*Type*.—U.S.N.M. No. 24495.

“Described from specimens from Mr. H. F. Wickham.”

(45) *TRIMORUS JUCUNDUS*, new species

*Female*.—Length 1.60 mm. Head about 1.7 times as wide as long seen from above, a little wider than the thorax; head with impressed reticulation except as follows: malar area and frons to about middle of eyes striate; frons with a median carina to anterior ocellus, this carina smaller toward the ocellus; an area to either side of this carina on lower half of frons polished, without sculpture; occiput with a few irregular indistinct ridges; scape about seven times as long as thick, a little longer than the five following joints combined; third joint about twice as long as thick, subequal to the fourth; club a little shorter than the scape; mesonotum closely and rather finely punctate; parapsidal grooves not present; scutellum closely impressed-reticulate; spine on metanotum moderately long, acute at apex; abdomen a little longer than the head and thorax combined, intermediate in width between the head and thorax; petiole about as long as wide, with deep longitudinal grooves separated by narrow rounded ridges; second tergite about as long as wide, nearly one and one-half times as long as the petiole, with numerous longitudinal grooves about as wide as those on the petiole; these grooves deep anteriorly, shallower posteriorly, reaching to apical one-fifth, each one becoming narrower posteriorly, separated from one another by narrow rounded ridges; third tergite about as long as wide, about 2.3 times as long as the second, on anterior half with grooves which are similar to but smaller than those on the second tergite; for a short way past the middle of the tergite these grooves are replaced by fine wavy aciculae; apical third of the third tergite finely reticulate; third sternite punctate; wings hyaline, extending about a sixth the length of the abdomen past its apex; black; legs (except coxae which are black to very dark brown) bright reddish brown; tarsi brown.

*Type locality*.—Glen Echo, Md.

*Type*.—U.S.N.M. No. 57799.

Three specimens collected by the author on March 3 and 18, 1926. Paratype in Whittaker collection.



(46) *TRIMORUS CARABORUM* (Riley)

*Prosacanthus caraborum* RILEY, in Ashmead, U. S. Nat. Mus. Bull. 45, p. 191 (male, female), pl. 8, fig. 4 (female), 1893.

*Hoplogryon caraborum*, KIEFFER, Genera insectorum, fasc. 80B, p. 95, 1910; Das Tierreich, Lief. 48, p. 227, 1926.

*Type locality*.—Washington, D. C.

*Other locality*.—Arlington, Va.

*Type*.—U.S.N.M. No. 2241.

Described from specimens reared from eggs of a carabid beetle, *Chlaenius impunctifrons*, and from specimens collected in Arlington, Va.

(47) *TRIMORUS LEONARDI*, new species

*Female*.—Length 1.84 mm. Head about twice as wide as long, about as wide as the thorax; upper half of frons and vertex with a very dense impressed reticulation, coriaceous; occiput similarly but somewhat more delicately sculptured; frons smooth medially, striate laterally, with a sharp carina extending to the anterior ocellus; mesonotum and scutellum densely and finely punctate, subopaque; parapsidal grooves present as short shallow depressions posteriorly; spine on metanotum rather short, acute; thorax scarcely longer than wide, a little narrower than the abdomen; wings not quite reaching the apex of the abdomen; abdomen nearly one and two-thirds times as long as wide; petiole 1.3 times as wide as long, with about a dozen longitudinal grooves, with a pronounced transverse constriction just before the middle; second tergite twice as wide as long, twice as long as the petiole, with numerous longitudinal ridges extending to apical fifth, these ridges parallel to one another or diverging somewhat posteriorly; third tergite 1.5 times as wide as long, 2.3 times as long as the second, finely reticulate and with a few low flattened ridges on anterior three-fifths, without distinct pubescence except laterally; third sternite strongly striate; black; scape dark brown; flagellum piceous; trochanters yellow; coxae black; rest of legs reddish brown; wings brownish.

*Type locality*.—McLean Bogs, N. Y.

*Type*.—U.S.N.M. No. 57800.

One specimen collected May 16, 1925, by M. D. Leonard.

It is with pleasure that I dedicate this species to my friend Mr. Leonard.

(48) *TRIMORUS PUNCTIVENTRIS* (Ashmead)

*Prosacantha punctiventris* ASHMEAD, U. S. Nat. Mus. Bull. 45, p. 192, 1893 (female).

*Hoplogryon punctiventris*, KIEFFER, Genera insectorum, fasc. 80B, p. 95, 1910; Das Tierreich, Lief. 48, p. 227, 1926.

*Type locality*.—Fortress Monroe, Va.

*Other locality*.—District of Columbia (male, not described).

*Type*.—U.S.N.M. No. 24502.

(49) **TRIMORUS ANNULICORNIS** (Ashmead)

*Prosacantha annulicornis* ASHMEAD, U. S. Nat. Mus. Bull. 45, p. 188, 1893 (female).

*Hoplogryon annulicornis*, KIEFFER, Genera insectorum, fasc. 80B, p. 95, 1910;

Das Tierreich, Lief. 48, p. 231, 1926.

*Type locality*.—Washington, D. C.

*Type*.—U.S.N.M. No. 2240.

Paratypes in the National Museum and in the collection of the American Entomological Society.

(50) **TRIMORUS PLEURALIS** (Ashmead)

*Prosacantha pleuralis* ASHMEAD, U. S. Nat. Mus. Bull. 45, p. 195, 1893 (female).

*Hoplogryon pleuralis*, KIEFFER, Genera insectorum, fasc. 80B, p. 95, 1910; Das

Tierreich, Lief. 48, p. 231, 1926.

*Type locality*.—District of Columbia.

*Type*.—U.S.N.M. No. 24509.

Described from two female specimens.

(51) **TRIMORUS SCULPTURATUS**, new species

*Female*.—Length 1.73 mm. Head about twice as wide as long, as wide as the thorax, slightly wider than the abdomen; occiput without sculpture except a few short wrinkles behind each lateral ocellus; vertex and upper half of frons with small widely scattered punctures; frons without a median carina except just above the antennae, striate below and narrowly on the sides up as far as the median ocellus; thorax a little wider than long; parapsidal grooves absent; mesonotum and scutellum regularly reticulate, the enclosed areas large and the margins high; anteriorly the areas are smaller; spine on metanotum long, acute; spines at lateral angles of propodeum likewise long and acute at apices; wings reaching the apex of the abdomen; abdomen about one and three-fourths times as long as wide, 1.7 times as long as the thorax; petiole one and one-third times as long as wide, with a hump-like elevation anteriorly, with about ten longitudinal ridges, these ridges not traversing the hump just mentioned; second tergite 1.4 times as wide as long, as long as the petiole, with about 12 longitudinal ridges extending nearly to the apical margin; some of these ridges bifurcate near basal fourth; each of the intervening grooves equally wide throughout its length or becoming somewhat wider apically; third tergite one and one-third times as wide as long, two and one-fourth times as long as the second, strongly and fairly closely punctate, the punctures arranged in more or less definite rows longitudinally; black; petiole, base of second abdominal segment, and thorax on sides, dark reddish brown; legs stramineous; scape light brown; mandibles yellow, the teeth reddish.

*Type locality*.—Glen Echo, Md.

*Type*.—U.S.N.M. No. 57801.

One specimen collected by the author in July.

(52) *TRIMORUS PETIOLATUS*, new species

*Female*.—Length 1.0 mm. Head slightly wider than the thorax; head and dorsum of thorax moderately thickly covered with short whitish hairs; frons with a delicate median carina from antennal base to anterior ocellus, striate at bases of mandibles on each side halfway between the median carina and the inner margin of the eye and extending upward as far as the middle of the eye is a narrow reticulate area; except for the striations and reticulations just mentioned the frons is polished, without sculpture; vertex without distinct sculpture; mesonotum rather finely sculptured, not punctate, with indistinct punctures; parapsidal grooves briefly indicated posteriorly; scutellum shining, with the anterior half somewhat roughened; spine on metanotum sharp and rather long; abdomen a little more than one and one-third times as long as wide, widest just behind the middle; petiole and second tergite with numerous grooves separated by sharp ridges, these grooves becoming narrower posteriorly; second tergite polished, without sculpture on apical half, twice as long as the first tergite; third tergite one and one-half times as wide as long, two and three-tenths times as long as the second, very delicately reticulate over its entire surface, sparsely pubescent laterally; wings normally developed, extending a little beyond the tip of the abdomen; black; legs yellowish brown, the femora and tibiae medially darker; petiole rufous; mandibles yellow; wings faintly brownish.

*Type locality*.—Cinnamon Lake, Schuyler County, N. Y.

*Type*.—U.S.N.M. No. 57802.

One specimen collected on June 5, 1925, by Prof. C. R. Crosby.

(53) *TRIMORUS RUFOCINCTUS*, new species

*Female*.—Length 1.20 mm. Head about twice as wide as long, as wide as the thorax, with fine white pubescence except medially on the frons; vertex and frons with dense impressed reticulation; frons above smooth, with small scattered punctures, smooth below, without sculpture except a fine median carina which extends to the anterior ocellus; thorax as wide as long, about as wide as the abdomen; mesonotum subopaque, pubescent, densely finely punctate; parapsidal grooves briefly indicated posteriorly; scutellum smooth, with fine sculpture anteriorly; spine on metanotum rather short, broad basally, acute apically; wings extending a little past the apex of the abdomen, brownish; abdomen 1.7 times as long as wide; petiole one and one-third times as wide as long, with about a dozen longitudinal grooves dorsally, the grooves extending its entire length; petiole not elevated anteriorly and without a transverse depression; second tergite 1.5 times as wide as long, 1.7 times as long as the petiole, with numerous ridges nearly to its apex, these ridges parallel with one another or diverging posteriorly; third tergite 1.4 times as wide as long, two and one-fourth

times as long as the second, with impressed reticulation, the areas rather large, with pubescence only laterally; black; scape brown at base; legs reddish, brown in part; petiole and base of second tergite reddish.

*Type locality*.—Glen Echo, Md.

*Type and paratype*.—U.S.N.M. No. 57803.

Six females collected July 21, 1921, by the author on low forest undergrowth along the Cabin John Creek.

Paratype in collection of Oscar Whittaker.

(54) **TRIMORUS FLAVOCINCTUS**, new species

*Female*.—Length 1.14 mm. Head about twice as wide as long, a little wider than the thorax, as wide as the abdomen, evenly covered, except for the frons medially, with short white pubescence; vertex and upper frons reticulate; frons otherwise smooth, without sculpture except for a fine median carina which extends to the anterior ocellus; thorax a little longer than wide, its upper surface covered, like the head, with short white pubescence; mesonotum subopaque, reticulate-punctate; parapsidal grooves briefly indicated posteriorly; scutellum finely reticulate; spine on metanotum moderate in length, acute at apex; wings extending a little past the apex of the abdomen; abdomen 1.7 times as long as wide; petiole 1.6 times as wide as long, with a few longitudinal grooves, not elevated anteriorly or depressed transversely; second tergite 1.6 times as wide as long, 1.3 times as long as the petiole, the ridges extending nearly to the apex, parallel or diverging posteriorly; third tergite 1.3 times as wide as long, 2.7 times as long as the second, without pubescence except laterally, smooth, delicately reticulate, the enclosed areas rather large; dark brown; scape at base, and all legs light brown; mandibles, petiole, and base of second tergite yellow; wings hyaline.

*Type locality*.—McLean Bogs, N. Y.

*Type*.—U.S.N.M. No. 57804.

One specimen collected May 16, 1925, by M. D. Leonard.

(55) **TRIMORUS XANTHOGNATHUS** (Ashmead)

*Prosacantha xanthognatha* ASHMEAD, U. S. Nat. Mus. Bull. 45, p. 197, 1893 (male).

*Hoplogryon xanthognathus*, KIEFFER, Genera insectorum, fasc. 80B, p. 95, 1910;

Das Tierreich, Lief. 48, p. 230, 1926.

*Type locality*.—Jacksonville, Fla.

*Type*.—U.S.N.M. No. 24516.

(56) **TRIMORUS CLARUS**, new species

*Female*.—Length 1.83 mm. Head as wide as the thorax, subconvex anteriorly, moderately excavated behind, 1.8 times as wide as long; frons with a strong carina to anterior ocellus, shortly striate below, striate laterally to just above middle of eye, with a small reticulate

area medially on each side just within the lateral striae, with small scattered punctures above; vertex reticulate; occiput impressed reticulate; thorax a little longer than wide, convex dorsally; parapsidal grooves short; mesonotum roughly sculptured, reticulate, irregularly transversely wrinkled anteriorly, more strongly longitudinally wrinkled posteriorly; scutellum smooth, without sculpture, sparsely covered with fine hairs; metanotal spine triangular, broad at base, acute at apex, about half as long as the scutellum; wings faintly brownish, extending about one-ninth the length of the abdomen past the latter's apex; abdomen 1.7 times as long as wide, 1.1 times as wide as the thorax, convex dorsally; petiole 1.3 times as wide as long, with several longitudinal ridges extending its entire length, very slightly transversely depressed in front of middle; second tergite 1.2 times as wide as long, 1.6 times as long as the petiole, with numerous longitudinal parallel or diverging ridges to apical fifth; several of these ridges bifurcate before middle; third tergite 1.45 times as wide as long, twice as long as the second, sparsely pubescent laterally and posteriorly, smooth, without sculpture of any kind; fourth tergite longer than the following combined, finely reticulate anteriorly; black; legs dark brown, the trochanters, tibiae basally and apically, and metatarsus of each leg, reddish brown.

*Type locality*.—Hollyburn, British Columbia.

*Type*.—U.S.N.M. No. 57805.

One specimen collected on September 27, 1929, by Oscar Whittaker.

(57) **TRIMORUS CALIFORNICUS** (Ashmead)

*Prosacantha californica* ASHMEAD, U. S. Nat. Mus. Bull. 45, p. 190, 1893 (female)

*Hoplogryon californicus*, KIEFFER, Genera insectorum, fasc. 80B, p. 95, 1910;

Das Tierreich, Lief. 48, p. 229, 1926.

*Type locality*.—Santa Cruz Mountains, Calif.

*Type*.—U.S.N.M. No. 24499.

(58) **TRIMORUS SILVATICUS**, new species

*Female*.—Length 1.36 mm. Head about twice as wide as long, 1.1 times as wide as the thorax, about as wide as the abdomen; occiput and vertex laterally with close impressed reticulation; frons striate below and laterally nearly to top of eye, pubescent above, with a carina to anterior ocellus; thorax scarcely longer than wide; mesonotum scaly-reticulate anteriorly, irregularly wrinkled posteriorly, subopaque, covered with short semierect hairs; parapsidal grooves briefly indicated posteriorly; scutellum smooth, without distinct sculpture; spine on metanotum rather short, acute; lateral angles of propodeum very short, tubercle-like; anterior wings nearly four times as long as wide, not quite attaining the tip of the abdomen, light brownish; abdomen 1.75 times as long as wide, 1.75 times as long as the thorax; petiole

1.3 times as wide as long, with a number of longitudinal grooves extending to anterior fourth, not elevated anteriorly or depressed transversely; second tergite nearly 1.4 times as wide as long, 1.5 times as long as the petiole, with numerous slightly diverging ridges on basal four-fifths, the intervening grooves broad and shallow; third tergite 1.4 times as wide as long, twice as long as the second, smooth, without sculpture, without pubescence except laterally and narrowly posteriorly; black; legs dark brown; knees, anterior tibiae apically, and tarsi yellowish brown; petiole very dark reddish.

*Type locality*.—Hollyburn, British Columbia.

*Type*.—U.S.N.M. No. 57806.

Two females collected on May 15 and June 9, 1928, by Oscar Whittaker.

Paratype in Whittaker collection.

(59) *TRIMORUS CRASSICORNIS* (Kieffer)

*Hoplogryon crassicornis* KIEFFER, Berliner Ent. Zeitschr, vol. 50, p. 262, 1905; Das Tierreich, Lief. 48, p. 216, 1926.

*Habitat*.—California: Santa Clara and San Mateo. Nevada: Ormsby.

*Type*.—In Kieffer collection.

(60) *TRIMORUS VIRGINIENSIS* (Kieffer)

*Hoplogryon tibialis* (non Foerster, 1841) ASHMEAD, U. S. Nat. Mus. Bull. 45, p. 203, 1893 (female).—BRUES, Genera insectorum, fasc. 80, p. 25, 1908.

*Hoplogryon virginiensis* KIEFFER, Genera insectorum, fasc. 80B, p. 98, 1910; Das Tierreich, Lief. 48, p. 218, 1926.

*Type locality*.—Virginia.

*Type*.—U.S.N.M. No. 24523.

Described from one specimen.

(61) *TRIMORUS CLARIPENNIS* (Ashmead)

*Hoplogryon claripennis* ASHMEAD, U. S. Nat. Mus. Bull. 45, p. 203, 1893 (female).—BRUES, Genera insectorum, fasc. 80, p. 25, 1908.—KIEFFER, Genera insectorum, fasc. 80B, p. 96, 1910.—BRUES, Connecticut Geol. Nat. Hist. Surv. Bull. 22, p. 553, 1916.—KIEFFER, Das Tierreich, Lief. 48, p. 218, 1926 (female).

*Female*.—Length 1.34 mm. Head twice as wide as long, about as wide as the thorax, as wide as the abdomen; cheeks and extreme lower part of frons strongly striate; rest of frons and vertex polished; antennae fuscous, the base of scape paler; pedicel, third, and fourth joint subequal in length and width, the pedicel a little shorter, about twice as long as wide; third and fourth joints a little over twice as long as wide; mesonotum subopaque, slightly roughened, punctulate; parapsidal grooves faintly indicated as small depressions on each side posteriorly on the mesonotum; wings hyaline, rounded apically, extending a little past the tip of the abdomen; abdomen 1.65 times as long as wide, 1.6 times as long as the thorax; petiole

about as wide as long, traversed longitudinally by deep grooves; second tergite with deep grooves medially to apical third, the grooves shorter laterally; area posterior to the grooves smooth, without sculpture; third tergite 1.35 times as wide as long, faintly reticulate; metanotal spine moderately long, acute at apex, extending horizontally.

*Type locality*.—Virginia.

Redescribed from the type, U.S.N.M. No. 24524.

(62) *TRIMORUS CONCINNUS*, new name

*Hoplogryon coxalis* FOUTS, Proc. Ent. Soc. Washington, vol. 27, p. 103, 1925 (female); Cornell Univ. Mem. 101, p. 964, 1928.

The name *coxalis* is preoccupied in *Trimorus* by *coxalis* Thomson (described in *Prosacantha* in 1859).

*Type locality*.—Suffern, N. Y.

*Type*.—In the author's collection.

Originally described from one specimen collected on May 26, 1924, by Prof. C. R. Crosby.

The type of *coxalis* Fouts was compared with the type of *virginiensis* Kieffer and appeared to differ only in having the abdomen about as long as the head and the thorax combined. They may be identical specifically.

(63) *TRIMORUS PENNSYLVANICUS* (Ashmead)

*Prosacantha pennsylvanica* ASHMEAD, U. S. Nat. Mus. Bull. 45, p. 189, 1893 (female).

*Hoplogryon pennsylvanicus*, KIEFFER, Genera insectorum, fasc. 80B, p. 95, 1910; Das Tierreich, Lief. 48, p. 228, 1926.

*Habitat*.—Pennsylvania.

*Type*.—In Berlin Museum.

Described from one specimen.

(64) *TRIMORUS BREVICARINATUS*, new species

*Female*.—Length 0.90 mm. Head about twice as wide as long, a little wider than the thorax, the latter as wide as the abdomen; occiput and vertex delicately reticulate; frons without sculpture except a fine median carina which does not quite reach the anterior ocellus; thorax as wide as long; mesonotum apparently finely reticulate but the sculpture somewhat obscured by the short pubescence; scutellum smooth, slightly roughened anteriorly; parapsidal grooves absent; spine on metanotum short, acute, less than half as long as the petiole; wings about two and one-half times as wide as the cilia on the distal margins are long, extending about a fourth the length of the abdomen past the latter's apex; abdomen 1.7 times as long as wide; petiole about as long as wide, shaped and sculptured as in *monticolus*, with a narrow row of longitudinal grooves across its middle; second tergite 1.6 times as wide as long, 1.6 times as long as the petiole, with



deep longitudinal grooves on anterior half; the grooves are narrowed to points apically and their edges are clear and sharp; the grooves are moreover not branched or divided, each one is distinct from every other one; third tergite 1.4 times as wide as long, delicately reticulate; black; legs dark brown, the trochanters lighter; wings hyaline.

*Type locality*.—Glen Echo, Md. (August 14, 1916.)

*Type*.—U.S.N.M. No. 57807.

*Paratype localities*.—Washington, D. C. (August 14, 1917), and Brownwood, Tex. (April 20, 1924), Pecan Bayou.

Three females collected by the author on the dates and at the localities indicated above. The paratype from Washington was collected on lawn grass.

Paratype in Whittaker collection, 0.77 mm. in length.

(65) **TRIMORUS PUNCTIGER**, new species

*Female*.—Length 1.80 mm. Head about as wide as the thorax, as wide as the abdomen; occiput shining, very faintly reticulate; an area behind each lateral ocellus impressed-reticulate; frons smooth, sparsely punctate on upper half, striate below and on the sides; the striae become gradually less numerous as they approach the upper frons and vanish just above the middle of the eyes; the usual carina on the frons is represented only by a short and faint suture in the middle of the frons; thorax a little longer than wide; mesonotum punctate except posteriorly, the punctures rather large and shallow, more than their diameter distant from one another; posteriorly the mesonotum is coarsely reticulate, the areas large and elongate anteroposteriorly; parapsidal grooves short, quickly lost in the coarse reticulation; scutellum coarsely reticulate like the posterior part of the mesonotum; spine on metanotum in the form of a broad, roughly sculptured plate with a little rounded nipple at its apex; lateral angles of propodeum prominent, acute; wings extending slightly past the apex of the abdomen, faintly brownish in color; abdomen a little more than one and one-half times as long as wide; petiole 1.1 times as wide as long, with about a dozen strong longitudinal ridges, the intervening grooves wrinkled; there is no smooth area along the apical margin of the segment as is usual, the ridges attaining the extreme edge; second tergite two and one-half times as wide as long, as long as the petiole, with numerous longitudinal ridges which extend to the apical fourth of the segment, the intervening grooves shallow, somewhat narrower than those on the petiole; third tergite 1.3 times as wide as long, 3.1 times as long as the second, closely impressed-reticulate, anteriorly finely longitudinally wrinkled; no pubescence except sparsely on the sides; black; legs reddish brown; coxae dark brown; scape at base brownish.

*Type locality*.—Glen Echo, Md.

*Type*.—U.S.N.M. No. 57808.

One specimen collected by the author.

A remarkable species, easily separated by many characters from any species known to me.

(66) *TRIMORUS NANUS* (Ashmead)

*Prosacantha nana* ASHMEAD, U. S. Nat. Mus. Bull. 45, p. 191, 1893 (female).

*Hoplogryon nanus*, KIEFFER, Genera insectorum, fasc. 80B, p. 95, 1910; Das Tierreich, Lief. 48, p. 229, 1926.

*Type locality*.—Utah Lake, Utah.

*Type*.—U.S.N.M. No. 24501.

Originally described from a single female specimen.

(67) *TRIMORUS LONGIPENNIS* (Ashmead)

*Hoplogryon longipennis* ASHMEAD, U. S. Nat. Mus. Bull. 45, p. 202, pl. 8, fig. 6, 1893 (female).—HARRINGTON, Trans. Roy. Soc. Canada, ser. 2, vol. 5, sect. 4, p. 184, 1899 (male).—BRUES, Genera insectorum, fasc. 80, p. 25, 1908.—KIEFFER, Genera insectorum, fasc. 80B, p. 97, 1910; Das Tierreich, Lief. 48, p. 217, 1926 (male, female).

*Prosacantha laevifrons* ASHMEAD, U. S. Nat. Mus. Bull. 45, p. 190, 1893 (female).

*Hoplogryon pteridis* ASHMEAD, *ibid.*, p. 203 (female).—BRUES, Genera insectorum, fasc. 80, p. 25, 1908.—KIEFFER, Genera insectorum, fasc. 80B, p. 97, 1910; Das Tierreich, Lief. 48, p. 216, 1926 (female).

*Prosacantha levis* DALLA TORRE, Catalogus hymenopterorum, vol. 5, p. 507, 1898.—BRUES, Genera insectorum, fasc. 80, p. 22, 1908.

*Hoplogryon levis*, KIEFFER, Genera insectorum, fasc. 80B, p. 95, 1910; Das Tierreich, Lief. 48, p. 229, 1926 (female).

*Female*.—Length 0.97 mm. Head a little over twice as wide as long, as wide as the thorax; upper part of frons, vertex, and occiput with dense impressed reticulation, beadlike in appearance; lower frons medially smooth, without sculpture except a delicate impression to anterior ocellus; frons laterally reticulate; clypeus, lower frons laterally, and malar area, striate; thorax a little wider than long, decidedly flattened above, as wide as the abdomen; mesonotum closely scaly reticulate, the sculpture strong, with short parapsidal grooves posteriorly; scutellum with sculpture which is similar to, but more delicate than, that on the mesonotum; metanotal spine short, acute; wings subhyaline, extending a little past the apex of the abdomen; abdomen one and one-fourth times as long as wide, broadly ovate, rounded posteriorly; petiole about twice as wide as long, without a transverse depression and with the anterior margin not reflexed; second tergite a little more than twice as wide as long, with numerous parallel ridges to apical fourth; third tergite 1.5 times as wide as long, with uniform close impressed reticulation; black; scape dark reddish brown; legs light brown, the femora and tibiae darker brown; coxae dark brown.

Description based on two specimens in the author's collection from Virginia and Glen Echo, Md. The specimen from Virginia, collected on July 13, was compared with the type of *Hoplogryon pteridis* Ashmead and seemed to be conspecific with it. The specimen from Glen Echo was compared with Ashmead's type of *Prosacantha laevifrons* with similar results. Some years ago the author had the opportunity of comparing the type of *Prosacantha laevifrons* with the type of *Hoplogryon longipennis* and found no specific differences between them.

This species is known to occur in Ottawa, Canada; Fortress Monroe and Arlington, Va.; Glen Echo, Md.; and the District of Columbia.

*Type*.—U.S.N.M. No. 24521 (*longipennis*).

(68) **TRIMORUS NIGRICOXA**, new species

FIGURES 13, 15

*Female*.—Length 1.63 mm. Head 2.2 times as wide as long, as wide as the thorax; frons, except an area above the bases of the antennae extending as far up as the middle of the eyes, and vertex with very close reticulate sculpture, beadlike in appearance; frons with a

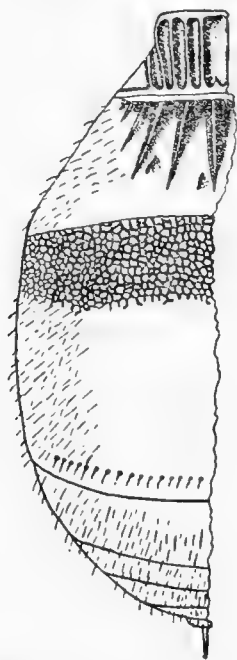


FIGURE 15.—*Trimorus nigricoxa*, new species: Dorsal view of abdomen. Only part of the sculpture is shown on the third tergite, the reticulation being continuous.

strong carina from antenna to anterior ocellus; head, except the smooth area described above, and dorsal surface of thorax thickly covered with short white hairs; scape about one and one-sixth times as long as the club, the latter about equal in length to joints 2–6 inclusive combined; mesonotum subopaque, very closely covered with small punctures; parapsidal grooves indicated as short broad depressions;

scutellum somewhat less strongly punctate than the mesonotum; spine on metanotum short, broad basally, acute apically; lateral angles of propodeum moderately produced, acute; abdomen broadly elliptical, 1.1 times as wide as the thorax, 1.6 times as long as wide; petiole 1.5 times as wide as long, with eight or nine longitudinal grooves separated by sharp ridges; second tergite 1.8 times as wide as long, 1.4 times as long as the petiole, with about ten grooves basally, these grooves deep anteriorly, becoming wider and shallower posteriorly, separated by sharp ridges; these ridges extend to the apical fourth of the segment; the grooves become more and more shallow and merge with the smooth area behind; third tergite 1.3 times as wide as long, 2.4 times as long as the second, with uniform impressed reticulation, pubescent only laterally; following tergites with close impressed reticulation, with fine scattered punctures; wings faintly brownish, extending slightly past the apex of the abdomen; black; trochanters, tibiae at extreme bases, and anterior tibiae at apices reddish yellow; femora and tibiae otherwise very dark brown; apical joints of tarsi brown.

*Type locality*.—Chilliwack, British Columbia.

*Type*.—U.S.N.M. No. 57809.

Five specimens collected by Oscar Whittaker on September 4, 6, and 8, 1926, and September 9 and 13, 1927. One paratype in Whittaker collection.

(69) *TRIMORUS WHITTAKERI*, new species

*Female*.—Length 1.16 mm. Head about twice as wide as long, a little wider than the thorax; frons reticulate laterally and above, smooth medially, with a median ridge to anterior ocellus, evenly pubescent except on the smooth median area; vertex and occiput impressed reticulate; thorax as wide as long; mesonotum scaly-reticulate, evenly and closely pubescent; parapsidal grooves apparently not present; scutellum very closely impressed-reticulate, pubescent; spine on metanotum short-acute; lateral angles of propodeum projecting, acute; wings extending a little less than a third the length of the abdomen past the latter's apex; abdomen 1.4 times as long as wide, a little wider than the head, slightly longer than the head and thorax together; petiole twice as wide as long, with about a dozen longitudinal grooves which very nearly reach the margins of the segment, not elevated anteriorly and without a transverse depression; second tergite twice as wide as long, twice as long as the petiole, with about a dozen longitudinal ridges with deep intervening grooves; these ridges are parallel or diverge slightly from one another posteriorly, extending to apical third; third tergite 1.4 times as wide as long, impressed-reticulate, uniformly pubescent, 2.7 times as long as the

second; black; trochanters, knees, tibiae apically, and all tarsi reddish brown; wings brownish.

*Type locality*.—Chilliwack, British Columbia.

*Type*.—U.S.N.M. No. 57810.

One specimen collected April 4, 1925, by Oscar Whittaker.

It gives me great pleasure to name this interesting species after my friend and collaborator Mr. Whittaker.

(70) **TRIMORUS OBSCURUS**, new species

*Female*.—Length 1.22 mm. Head about as wide as the thorax; vertex and upper half of frons impressed-reticulate; frons otherwise without sculpture except a small reticulate area midway between antenna and eye on each side; frons with a fine median carina to the anterior ocellus; thorax about as wide as long, a little narrower than the abdomen; mesonotum and scutellum thickly clothed with short whitish pubescence, the former with a rough reticulation, the areas rather small; scutellum less strongly sculptured, impressed-reticulate; parapsidal grooves absent; spine on metanotum short, blunt, barely projecting; lateral angles of propodeum short, blunt; wings distinctly brownish, extending a little past the apex of the abdomen; abdomen 1.6 times as long as wide; petiole about as long as wide, not elevated anteriorly and without a transverse constriction, with about 10 longitudinal grooves which very nearly reach both margins; second tergite twice as wide as long, scarcely longer than the petiole, with about a dozen strong longitudinal ridges which extend medially nearly to the posterior margin of the segment; the grooves between these ridges are broad, and each is equally wide throughout its length or widens somewhat posteriorly; third tergite 1.35 times as wide as long, 2.6 times as long as the second, finely reticulate, the areas rather large, without pubescence medially on anterior half; black; knees, anterior tibiae apically, and tarsi, reddish brown.

*Type locality*.—Chilliwack, British Columbia.

*Type*.—U.S.N.M. No. 57811.

Two specimens collected on August 22 and 29, 1926, by Oscar Whittaker.

Paratype in Whittaker collection.

(71) **TRIMORUS BILINEATUS** (Ashmead)

*Prosacantha bilineata* ASHMEAD, U. S. Nat. Mus. Bull. 45, p. 194, 1893 (female).

*Hoplogryon bilineatus*, KIEFFER, Genera insectorum, fasc. 80B, p. 95; 1910; Das Tierreich, Lief. 48, p. 230, 1926.

*Type locality*.—Washington, D. C.

*Type*.—U.S.N.M. No. 24508.

Originally described from four female specimens.

(72) *TRIMORUS PULCHELLUS*, new species

*Female*.—Length 1.56 mm. Head about twice as wide as long, about as wide as the abdomen, very little wider than the thorax; vertex and occiput with impressed reticulation; frons smooth, with a few minute scattered punctures on upper half; below and on the sides the frons is striate; median carina on frons inconspicuous and not present on upper half; thorax about as wide as long; parapsidal grooves not present or obscured by the heavy wrinkles on the mesonotum; mesonotum on anterior half scaly-impressed-reticulate, the areas very small; posterior half of mesonotum with heavy irregular wrinkles, not reticulate; scutellum densely impressed-reticulate, the areas very small, about the size of those on the anterior half of the mesonotum; spine on metanotum very short, lamelliform, broadly rounded posteriorly; posterior angles of propodeum projecting slightly, acute; wings brownish, reaching the apex of the abdomen; abdomen not quite twice as long as wide; petiole about as long as wide, distinctly but not greatly elevated anteriorly, with about 12 longitudinal grooves its entire length; second tergite 1.3 times as wide as long, a little longer than the petiole, with about 12 longitudinal ridges nearly reaching the posterior margin; the intervening grooves are flat, shallow, with approximately parallel sides; third tergite 1.2 times as wide as long, 2.3 times as long as the second, impressed-reticulate, more strongly so anteriorly; pubescence on third tergite sparse, present only laterally and posteriorly; black; knees, tibiae apically, and tarsi, except distal joints, reddish brown.

*Type locality*.—Chilliwack, British Columbia.

*Type*.—U.S.N.M. No. 57812.

Two specimens collected April 1, 1926, and June 12, 1927, by Oscar Whittaker.

Paratype in Whittaker collection.

(73) *TRIMORUS VINCTUS*, new name

*Hoplogryon similis* FOUTS, Proc. Ent. Soc. Washington, vol. 26, p. 160, 1924.

The name *similis* is preoccupied in *Trimorus* by *similis* Thomson (described in *Prosacantha* in 1859).

*Type locality*.—Ames, Iowa.

*Type*.—U.S.N.M. No. 26833.

(74) *TRIMORUS MONTICOLA*, new species

*Female*.—Length 0.88 mm. Head a little wider than the thorax; vertex smooth; occiput apparently delicately reticulate; frons smooth, without sculpture except a few fine striae below on the sides; median carina on frons not extending past the middle; thorax about as wide as long, as wide as the abdomen; mesonotum and scutellum pubescent, the hairs obscuring the very delicate sculpture; parapsidal grooves

absent; spine on metanotum short, acute; lateral angles of propodeum not projecting; wings extending about one-fourth the length of the abdomen past the latter's apex, hyaline, the cilia on the distal margins about a third as long as the wing is wide; abdomen 1.7 times as long as wide; petiole about as long as wide, with a row of short longitudinal grooves across its middle, otherwise smooth, without sculpture dorsally; second tergite twice as wide as long, 1.2 times as long as the petiole, with deep longitudinal grooves on anterior two-thirds; the ridges or intervals are parallel to each other and do no branching posteriorly; third tergite twice as wide as long, 1.7 times as long as the second, uniformly finely reticulate, the areas large and elongate anteroposteriorly; dark reddish brown; legs dark brown, the trochanters and anterior tibiae apically, yellowish.

*Type locality*.—Mount Holly Springs, Pa.

*Type*.—U.S.N.M. No. 57813.

One specimen swept from wheat by the author (July 16, 1920).

(75) **TRIMORUS TEXANUS**, new species

*Female*.—Length 1.62 mm. Head as wide as the thorax, a little wider than the abdomen; vertex finely reticulate laterally; occiput smooth, faintly reticulate; frons smooth, not reticulate, with a median carina extending to the anterior ocellus, striate laterally on lower half with a few minute scattered punctures above; mesonotum shagreened, shining, covered, as is also the scutellum with short whitish hairs; parapsidal grooves not sharply defined, nearly reaching the middle of the mesonotum; scutellum smooth, indistinctly shagreened anteriorly; spine on metanotum long, sharp at apex, nearly as long as the scutellum; lateral angles of propodeum projecting, acute; wings hyaline, extending a little more than one-fourth the length of the abdomen past the latter's apex; abdomen 1.7 times as long as wide; petiole about as long as wide, with a smooth rounded elevation anteriorly, the grooves, about ten in number, reaching to the middle of the segment; second tergite 1.3 times as wide as long, 1.5 times as long as the petiole, the ridges, which are mostly bifurcate medially, extending to posterior fourth; third tergite 1.5 times as wide as long, 1.8 times as long as the second, with an evenly (except narrowly laterally and posteriorly) distributed impressed reticulation, not pubescent medially; black; legs mostly light reddish brown; coxae, tibiae, except proximally, and posterior femora apically, fuscous.

*Type locality*.—Brownwood, Tex.

*Type*.—U.S.N.M. No. 57814.

One specimen collected on May 1, 1924, in Pecan Bayou by the author.



(76) *TRIMORUS MINOR*, new species

*Female*.—Length 1.50 mm. Head about two and one-fourth times as wide as long, as wide as the thorax, about as wide as the abdomen; occiput reticulate; vertex smooth; frons mostly smooth, without sculpture, striate just above the antennae and a spot on each side at about the middle of the eyes reticulate; thorax a little wider than long; mesonotum rather delicately scaly-reticulate, without a trace of parapsidal grooves; scutellum smooth, with a fine scaly reticulation anteriorly; spine on metanotum long, sharp, nearly as long as the petiole; lateral angles of propodeum projecting slightly, acute; wings hyaline, extending about one-seventh the length of the abdomen past the latter's apex; abdomen one and three-fourths times as long as wide, nearly 1.9 times as long as the thorax; petiole about as long as wide, not distinctly elevated anteriorly, the grooves not reaching the anterior margin medially; posterior fifth of the petiole smooth, without sculpture; second tergite 1.5 times as wide as long, 1.6 times as long as the petiole, traversed on basal three-fourths by numerous deep longitudinal grooves; the intervening ridges are flattened dorsally and become wider posteriorly; the upper edges of these ridges are on a level with the smooth surface behind them; third tergite 1.4 times as wide as long, twice as long as the second, uniformly finely reticulate, the areas moderately large; third tergite pubescent only laterally, polished along the posterior margin; black; coxae dark brown; legs mostly light brownish.

*Type locality*.—Rosslyn, Va.

*Type*.—U.S.N.M. No. 57815.

One specimen collected on June 8 by the author.

(77) *TRIMORUS MELANOPUS* (Ashmead)

*Prosacantha melanopus* ASHMEAD, U. S. Nat. Mus. Bull. 45, p. 189, 1893 (female).—BRUES, *Genera insectorum*, fasc. 80, p. 22, 1908.

*Hoplogryon melanopus*, KIEFFER, *Genera insectorum*, fasc. 80B, p. 95, 1910; *Das Tierreich*, Lief. 48, p. 228, 1926 (female).

*Female*.—Length 1.47 mm. Head twice as wide as long, slightly wider than the thorax, the latter as wide as the abdomen; frons striate below, reticulate except medially below, less strongly reticulate medially on the sides, the reticulation impressed below on the sides and above; vertex and occiput impressed, the sculpture beadlike; frons with a median carina nearly to anterior ocellus, the carina replaced by a thin line just below the ocellus; thorax as wide as long, strongly convex dorsally; mesonotum and scutellum evenly pubescent, finely scaly-reticulate; parapsidal grooves on posterior third, indistinct; metanotal spine triangular viewed from above, acute apically, about half as long as the scutellum; lateral angles of propodeum projecting slightly, blunt apically; wings tinged with brown, reaching

to the tip of the abdomen; abdomen 1.6 times as long as wide; petiole 1.35 times as wide as long, with numerous grooves to anterior margin which is narrowly reflexed, without a transverse depression; second tergite twice as wide as long, 1.3 times as long as the petiole, with parallel or slightly diverging ridges to apical fourth; laterally where the ridges are shorter, the surface is impressed reticulate; third tergite 1.45 times as wide as long, 2.1 times as long as the second, very strongly impressed reticulate, faintly reticulate laterally, polished narrowly along posterior margin; fourth tergite impressed-reticulate anteriorly; following tergites smooth, without sculpture; black; legs dark brown, the knees, tibiae distally, and tarsi, except terminal joints reddish brown.

*Type locality*.—Ottawa, Canada.

*Type*.—U.S.N.M. No. 24497.

*New locality*.—Chilliwack, British Columbia.

Redescribed from one specimen collected June 9, 1926, by Oscar Whittaker. This specimen was compared with the type of *melanopus* in the National Museum at Washington.

(78) **TRIMORUS RETICULATUS**, new species

*Female*.—Length 1.17 mm. Head about as wide as the thorax, a little wider than the abdomen; vertex, occiput, and frons above, and below on the sides, with impressed reticulation; a few small punctures in the reticulation above on the frons; frons with a fine median carina to median ocellus, otherwise, except as noted above, smooth, without sculpture; thorax as wide as long, about as wide as the abdomen; mesonotum and scutellum smooth, with a fine, somewhat indistinct, reticulation; parapsidal grooves short; metanotal spine moderately long, acute apically; lateral angles of propodeum rather long, acute; wings hyaline, extending nearly a fifth the length of the abdomen past the latter's apex; abdomen 1.6 times as long as wide; petiole about twice as wide as long, evenly rounded above, with about twelve longitudinal grooves extending to the anterior margin; petiole not elevated anteriorly and with a transverse depression; second tergite 1.8 times as wide as long, 1.4 times as long as the petiole, with about twelve grooves extending to apical third; third tergite 1.45 times as wide as long, 2.4 times as long as the second, with uniform, moderately impressed reticulation over its entire surface (except narrowly laterally and posteriorly), without pubescence medially; black; legs dark brown, the trochanters, knees, anterior tibiae apically, and tarsi, lighter.

*Type locality*.—Glen Echo, Md.

*Type*.—U.S.N.M. No. 57816.

One specimen collected in August 1922 by the author.

(79) *TRIMORUS FUMIPENNIS* (Ashmead)

- Gryon fumipennis* ASHMEAD, U. S. Nat. Mus. Bull. 45, p. 206, 1893 (female).—BRUES, *Genera insectorum*, fasc. 80, p. 25, 1908.
- Paragryon fumipennis*, KIEFFER, *Genera insectorum*, fasc. 80B, p. 99, 1910.—BRUES, *Connecticut Geol. Nat. Hist. Surv. Bull.* 22, p. 553, 1916.—KIEFFER, *Das Tierreich*, Lief. 48, p. 236, 1926 (female).

*Female*.—Length 1.33 mm. Head 1.9 times as wide as long, a little wider than the thorax, the latter as wide as the abdomen; frons shortly striate below on the sides, with a fine median carina to anterior ocellus, with very fine punctures above; vertex and occiput reticulate, the areas small; thorax about as wide as long, subconvex above; mesonotum scaly-reticulate anteriorly, with a few transverse wrinkles, closely punctate posteriorly, with parapsidal grooves short; scutellum subconvex, reticulate anteriorly, polished posteriorly; metanotal spine short, acute; wings hyaline, about reaching tip of abdomen; lateral angles of propodeum short, blunt; abdomen twice as long as wide, about twice as long as the thorax, elliptical seen from above; petiole about 1.4 times as long as wide, with fine ridges to anterior margin, the dorsal surface sloping gradually upward to anterior margin from a narrow trough-shaped transverse depression near apex; second tergite 1.3 times as wide as long, 1.3 times as long as the petiole, with numerous slightly diverging ridges nearly to apex, all the ridges of approximately equal length; narrow area behind the ridges polished; third tergite 1.2 times as wide as long, 2.2 times as long as the second, uniformly impressed reticulate except laterally where it is faintly reticulate, and posteriorly where it is narrowly polished; tergites 4–6 reticulate anteriorly; body the color of mahogany; antennae piceous, the scape dark brown, yellowish brown on proximal half; legs, including coxae, stramineous.

*Type locality*.—District of Columbia.

*Type*.—U.S.N.M. No. 24528.

*New locality*.—Jacksonville, Fla.

Redescribed from one specimen in the author's collection. It was compared with the type of *Gryon fumipennis* Ashmead.

(80) *TRIMORUS SCHWARZII* (Ashmead)

- Prosacantha schwarzii* ASHMEAD, U. S. Nat. Mus. Bull. 45, p. 192, 1893 (female).
- Hoplogryon schwarzii*, KIEFFER, *Genera insectorum*, fasc. 80B, p. 95, 1910; *Das Tierreich*, Lief. 48, p. 232, 1926.

*Type locality*.—Washington, D. C.

*Type*.—U.S.N.M. No. 24503.

Originally described from one female specimen.

(81) *TRIMORUS NIGROBRUNNEUS*, new species

*Female*.—Length 1.16 mm. Head twice as wide as long, about as wide as the thorax; occiput and vertex with dense impressed reticula-

tion; laterally and above the frons is reticulate, below it is striate, medially it has a fine carina to anterior ocellus, otherwise smooth, without sculpture; mesonotum and scutellum uniformly pubescent, the former with a rather fine scaly-reticulate sculpture, the latter smooth, with a slightly roughened reticulate sculpture anteriorly; parapsidal grooves not present; spine on metanotum short, acute; thorax as wide as long; lateral angles of the propodeum about as long as the metanotal spine, subacute apically; wings extending a little less than a sixth the length of the abdomen past the latter's apex, lightly tinged with brown; abdomen nearly one and one-half times as long as wide, about one and one-eighth times as wide as the head; petiole about 1.7 times as wide as long, with a distinct but not deep transverse constriction, and with grooves which extend from its narrow polished posterior margin to its still narrower smooth anterior margin; second tergite about twice as wide as long, 1.4 times as long as the petiole, with about ten strong longitudinal ridges to posterior fourth, these ridges diverging from one another posteriorly; the intervening grooves are broad, with flat, smooth bottoms; third tergite 1.35 times as wide as long, 2.8 times as long as the second, uniformly finely reticulate, the impressions somewhat deeper and more strongly indicated anteriorly; black; legs brownish, the femora and tibiae in part somewhat darker.

*Type locality*.—Sudley, Md.

*Type*.—U.S.N.M. No. 57817.

One specimen collected on July 5, 1925, by the author.

(82) *TRIMORUS PERSPICUUS*, new species

*Female*.—Length 1.19 mm. Head about twice as wide as long, a little wider than the thorax, as wide as the abdomen, rather strongly convex anteriorly; frons striate shortly below, with a fine median carina from antennae to about the middle, with several small, indistinct punctures, otherwise without sculpture; occiput reticulate; cheeks finely reticulate; thorax a little longer than wide, convex dorsally; parapsidal grooves faintly indicated at base of mesonotum; mesonotum shining, with a faint reticulate sculpture; scutellum smooth, polished, with fine sculpture along the anterior margin; wings hyaline, extending about two-fifths the length of the abdomen past the latter's apex; abdomen 1.4 times as long as wide; petiole about twice as wide as long, with the anterior edge upturned, with a number of longitudinal ridges extending to the anterior margin; second tergite twice as wide as long, 1.4 times as long as the petiole, with numerous longitudinal ridges extending medially to posterior fourth; the grooves medially on the second tergite become narrower posteriorly, the intervening ridges flattened above, becoming wider behind

where they merge into the flat polished border of the segment; third tergite 1.5 times as wide as long, 2.4 times as long as the second, evenly reticulate except laterally, and narrowly posteriorly, the areas rather small; pubescence sparse laterally on the third tergite, not present except laterally; black; legs dark brown, the knees and tarsi paler.

*Type locality*.—Hollyburn, British Columbia.

*Type*.—U.S.N.M. No. 57818.

One specimen collected on August 25, 1928, by Oscar Whittaker.

(83) *TRIMORUS AMABILIS*, new species

*Female*.—Length 1.33 mm. Head about twice as wide as long, as wide as the thorax, as wide as the abdomen; malar area striate; frons just above malar areas reticulate; frons delicately reticulate and with distinct punctures above, with a median carina which vanishes above about midway between the antennae and the anterior ocellus; except as noted the frons is smooth, unsculptured; scape about seven times as long as thick, about one and one-third times as long as the five following joints combined; third joint about one and one-half times as long as thick, subequal to the fourth; club about as long as the scape; mesonotum and scutellum reticulate, with rather thick pubescence; parapsidal grooves not indicated; spine on metanotum rather broad anteriorly, acute at apex, reaching above middle of petiole; lateral posterior angles of propodeum projecting slightly, acute; abdomen not quite one and one-half times as long as wide, a little longer than the head and thorax combined; petiole nearly twice as wide as long, with numerous longitudinal grooves separated by narrowly rounded ridges, these grooves extending nearly to the apex of the segment; viewed from the side the upper edge of the petiole is straight; second tergite twice as wide as long, not quite twice as long as the petiole, with a number of grooves basally which are considerably wider than those on the petiole; these grooves medially on the segment become narrower posteriorly and extend about to the apical fourth; behind these grooves the surface of the second tergite is smooth, without sculpture; third tergite one and one-half times as wide as long, two and one-half times as long as the second, entirely closely reticulate, shining; wings light brownish, extending slightly past the apex of the abdomen; black; trochanters, femora at extreme apices, tibiae at extreme bases and apices, and metatarsus of each leg reddish brown.

*Type locality*.—Chilliwack, British Columbia.

*Type*.—U.S.N.M. No. 57819.

Two specimens collected by Oscar Whittaker on May 29 and May 30, 1926. Paratype in Whittaker collection.

## (84) TRIMORUS LEPIDUS, new species

*Female*.—Length 1.07 mm. Head about twice as wide as long, 1.1 times as wide as the thorax, a little wider than the abdomen; frons smooth, without sculpture except a small reticulate spot below on either side, with a fine carina extending to median ocellus; vertex without sculpture; occiput finely reticulate; thorax slightly longer than wide, a little narrower than the abdomen; mesonotum finely scaly-reticulate, apparently without parapsidal grooves; scutellum smooth posteriorly, reticulate anteriorly; spine on metanotum short, acute apically; lateral angles of propodeum projecting, blunt; wings extending two-fifths the length of the abdomen past the latter's apex; abdomen 1.6 times as long as wide; petiole about twice as wide as long, with a number of grooves which extend to the very narrowly reflexed anterior margin; second tergite 1.7 times as wide as long, 1.6 times as long as the petiole, sculptured as in *perspicuus*, except that the ridges extend to apical third; third tergite 1.4 times as wide as long, 2.45 times as long as the second, evenly reticulate, without pubescence except laterally where it is sparse; pubescence everywhere on the body sparse and fine; black; legs dark brown, the trochanters, knees, tibiae apically, and tarsi except distally, somewhat lighter; wings light brownish.

*Type locality*.—Hollyburn, British Columbia.

*Type*.—U.S.N.M. No. 57820.

Two females collected June 9, 1928, and September 27, 1929, by Oscar Whittaker. Paratype in Whittaker collection.

## NEARCTIC SPECIES NOT INCLUDED IN THE KEY

## TRIMORUS BETHUNEI (Sanders)

*Hoplogryon bethunei* SANDERS, Can. Ent., vol. 42, p. 15, 1910 (male).—KIEFFER, Genera insectorum, fasc. 80B, p. 96, 1910; Das Tierreich, Lief. 48, p. 214, 1926 (male).

Mr. Sanders's description, although very good, does not include information necessary to place the species in the key. No mention is made of the presence or absence of the parapsidal grooves, of the sculpture of the third sternite, or of the color of the coxae.

*Type locality*.—Aurora, Ill.

One specimen collected June 15, 1909, in the nest of *Formica subrufa*.

*Type*.—In Illinois State Laboratory of Natural History, Acc. No. 39771.

## TRIMORUS GRACILICORNIS (Ashmead)

*Prosacantha gracilicornis* ASHMEAD, U. S. Nat. Mus. Bull. 45, p. 193, 1893 (female).—BRUES, Genera insectorum, fasc. 80, p. 22, 1908.

*Hoplogryon gracilicornis*, KIEFFER, Genera insectorum, fasc. 80B, p. 95, 1910; Das Tierreich, Lief. 48, p. 228, 1926 (female).



Runs to couplet 45 in the key to the species. The original description fails to mention the sculpture of the third sternite.

*Type locality*.—Carolina.

*Type*.—In Berlin Museum.

**TRIMORUS LINELLII (Ashmead)**

*Prosacantha linellii* ASHMEAD, U. S. Nat. Mus. Bull. 45, p. 195, 1893 (female).—

BRUES, *Genera insectorum*, fasc. 80, p. 22, 1908.

*Hoplogryon linellii*, KIEFFER, *Genera insectorum*, fasc. 80B, p. 95, 1910; *Das Tierreich*, Lief. 48, p. 226, 1926 (female).—FOOTS, *Cornell Univ. Mem.* 101, p. 964, 1928.

Runs to couplet 41 in the key to the species. This species was not studied when the original key was made by the author, and so Ashmead's description must be used in placing it. The finely rugose sculpture of the mesonotum and scutellum serves to separate it from allied species that have the mesonotum punctate.

*Type locality*.—Long Island, N. Y.

*Type*.—U.S.N.M. No. 24510.

**TRIMORUS MACROCERUS (Ashmead)**

*Prosacantha macrocera* ASHMEAD, *Ent. Amer.*, vol. 3, p. 117, 1887 (male).—

CRESSON, *Synopsis of families and genera of Hymenoptera of America north of Mexico*, p. 313, 1887.—ASHMEAD, U. S. Nat. Mus. Bull. 45, p. 197, 1893 (male).—BRUES, *Genera insectorum*, fasc. 80, p. 22, 1908.

*Hoplogryon macrocerus*, KIEFFER, *Genera insectorum*, fasc. 80B, p. 95, 1910; *Das Tierreich*, Lief. 48, p. 226, 1926 (male).

Runs to couplet 34 in the key to the species. Further information is necessary before the species can be satisfactorily placed in the key.

*Type locality*.—Jacksonville, Fla.

*Type*.—U.S.N.M. No. 24515.

**TRIMORUS MINUTISSIMUS (Ashmead)**

*Prosacantha minutissima* ASHMEAD, *Ent. Amer.*, vol. 3, p. 117, 1887 (female).—

CRESSON, *Synopsis of families and genera of Hymenoptera of America north of Mexico*, p. 313, 1887.

*Hoplogryon minutissimus*, ASHMEAD, U. S. Nat. Mus. Bull. 45, p. 202, 1893 (female).—BRUES, *Genera insectorum*, fasc. 80, p. 25, 1908.—KIEFFER, *Genera insectorum*, fasc. 80B, p. 97, 1910.—BRUES, *Connecticut Geol. Nat. Hist. Surv. Bull.* 22, p. 553, 1916.—KIEFFER, *Das Tierreich*, Lief. 48, p. 217, 1926 (female).

Runs to couplet 59 in the key to the species. Differs from *silvaticus* in having the wings extending a little beyond the tip of the abdomen. From *californicus* it differs in being smaller, 0.75 mm. as against 1.8 in *californicus*.

*Type locality*.—Jacksonville, Fla.

*Type*.—U.S.N.M. No. 24522.



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# NEW PEMPHILIDINE WASPS FROM SOUTHERN NIGERIA

By V. S. L. PATE

THE present paper is a report on a small but very interesting collection of pemphilidine wasps (family Sphecidae) made by J. C. Bridwell in southern Nigeria. The types of all the new species are in the United States National Museum.

## Genus ENCOPOGNATHUS Kohl

This widely distributed genus, which reaches its maximum specific differentiation in Africa, is represented in the Ethiopian Region by only the nominate subgenus.<sup>1</sup> The following key will serve to separate the eight known species:

### KEY TO SPECIES OF THE SUBGENUS ENCOPOGNATHUS

1. Postscutellum armed posteriorly with a translucent lamella, or bilobate; abdomen more or less elongate. (*Brownei* group) ----- 2  
Postscutellum simple, unarmed posteriorly; abdomen relatively short and compact. (*Braueri* group) ----- 5
2. Postscutellum bilobate, produced backward on each side in form of a thick, opaque, trigonal laminate plate (Southern Rhodesia) *-chirindensis* (Arnold)  
Postscutellum furnished with a translucent lamella around posterior and lateral margins ----- 3
3. Abdomen with first three tergites coarsely rugosopunctate, fourth and fifth tergites more sparsely punctate; postscutellum yellow (Kenya to Southern Rhodesia) ----- *brownei* (Turner)  
Abdomen with first three tergites impunctate; postscutellum black ----- 4
4. Abdomen with fourth and fifth tergites granular to finely pustulate. Females with only middle tibiae yellow; pygidium yellow at base, ferruginous at apex (Belgian Congo) ----- *granulata* (Arnold)

<sup>1</sup> Pate, V. S. L., On the taxonomy of the genus *Encopognathus*. *Lloydia* (Cincinnati), vol. 6, pp. 53-76, 1943.

Abdomen with fourth and fifth tergites finely sparsely acupunctate. Females with all tibiae and tarsi light yellow; pygidium wholly ferruginous. Males with fore femora armed beneath with a retrorse spine; fore metatarsi irregularly laminate; scape irregularly widened and angulate subapically; pedicel produced into an acuminate lateral process (Nigeria).

acanthomerus, new species

5. Front armed between antennal sockets with a short, porrect, lamelliform tooth; postscutellum bisected by a carinule; abdomen black with tergites closely punctured, the first two quite coarsely so; second sternite very coarsely and sparsely punctate; pygidial area coarsely, closely punctate (Southern Rhodesia)-----rhodesiana (Arnold)

Front simple, unarmed; postscutellum not bisected by a carinule; abdomen impunctate or finely punctured at most----- 6

6. Abdomen black, the second and fourth tergites with yellow fasciae, the third with lateral spots, the fifth tergite wholly and the pygidium largely, yellow; smooth, shining, finely and sparsely punctate, but fifth tergite much more strongly and closely punctate than preceding tergites; the pygidium coarsely closely punctate (Senegambia)-----braueri (Kohl)

Abdomen red, not maculated with yellow; fifth tergite not appreciably more coarsely punctate than preceding tergites----- 7

7. Scutellum longitudinally striatorugose; eyes separated at their nearest point by a distance equal to three-fourths length of scape; postorbital carina continued onto the posterior margin of head (Natal)---rugosopunctata Turner

Scutellum with large scattered and well-separated variolate punctures; eyes separated at their nearest point by a distance equal to less than one-half length of scape; postorbital carina not continued onto posterior margin of head (Nigeria)-----bridwelli, new species

#### ENCOPOGNATHUS (ENCOPOGNATHUS) BRAUERI (Kohl)

*Crabro* (*Encopognathus*) *Braueri* KOHL, Ann. Naturhist. Hofmus. Wien, vol. 11, p. 486, fig. 89, 1896 (♀; Senegambia).

*T[hyreopus]* (*Encopognathus*) *Braueri* ARNOLD, Ann. Transvaal Mus., vol. 11, p. 346, 1926.

*Encopognathus* (*Encopognathus*) *braueri* PATE, Lloydia, vol. 6, pp. 75, 76, 1943.

This, the genotypic species, is known from only the unique female from Senegambia. The finely punctate, black, maculated abdomen readily separates *braueri* from the following three species.

#### ENCOPOGNATHUS (ENCOPOGNATHUS) RUGOSOPUNCTATA Turner

*Encopognathus rugosopunctatus* TURNER, Ann. Mag. Nat. Hist., ser. 8, vol. 9, p. 419, 1912 (♀; Durban, Natal).

*T[hyreopus]* (*Encopognathus*) *rugosopunctatus* ARNOLD, Ann. Transvaal Mus., vol. 11, p. 345, 1926.

*Encopognathus* (*Encopognathus*) *rugosopunctatus* PATE, Lloydia, vol. 6, p. 75, 1943.

The bright red, immaculate, finely punctate abdomen distinguishes *rugosopunctata* from all other members of the *braueri* group except *bridwelli*. The differential characters separating the present species from *bridwelli* have been presented in the foregoing key to species.

If all the pemphilidine wasps were to be placed in one blanket genus *Crabro*, as Arnold proposes, it would be necessary to rename this species inasmuch as it would then be a homonym of Taschenberg's 1875 Venezuelan species and also Provancher's 1882 Canadian form.

ENCOPOGNATHUS (ENCOPOGNATHUS) BRIDWELLI,<sup>2</sup> new species

FIGURE 16, *m*

The superficial habitus of *bridwelli* is very similar to that of Turner's Natal *rugosopunctata*, from which it may be differentiated by the variolate sculpture of the scutellum and the narrower front. In addition, the postorbital carinule of *bridwelli* is not continuous onto the vertex and the recurrent vein of the fore wing is received by the submarginal cell three-fifths of the way from its base, whereas in *rugosopunctata* the postorbital carinule is continuous dorsally on the vertex while the recurrent vein is received by the submarginal cell only two-fifths of the way from its base.

*Type*.—Female; Oloke-Meji to Ibadan, Lagos, southern Nigeria. (J. C. Bridwell; U. S. N. M. No. 58033.)

*Female*.—Length 8 mm. Black; the following stramineous: Basal half of mandibles (remainder red), scapes except for a small black spot behind; postscutellum with a small lateral spot on each side; fore and middle femora with a small spot at apex; all tibiae on outer faces; all tarsi except last segment. Fulvous: Apex of clypeal lobe; pronotal tubercles; fore femora; all tibiae beneath; last segment of all tarsi; trophi. Abdomen bright ferruginous. Wings clear hyaline, with a faint cloud in marginal cell; veins and stigma brunneous.

Head fulgid; clypeus except bevel, and inner orbits with a narrow band of silvery sericeous pile; temples with a thin vestiture of puberulent silvery hair. Front in scapal region strongly concave, impunctate, width at narrowest point about three-sevenths (0.436) the length of scape; upper front and vertex with scattered, irregular, coarse, variolate punctures; supraorbital foveae large, distinct, ovate, immarginate; ocelli in a curved line, the ocellocular line three-fourths the postocellar distance; postorbital carinule sharp, distinct, but not foveolate anteriorly or continuous above and separating the vertex from the occipital region, though with a low transverse ridge there medially; temples and occiput very finely punctulate. Antennae with sockets contiguous to nearest lower inner orbits; scapes simple, subcylindrical, ecarinate, about six-tenths the vertical eye length; pedicel obterete, seven-tenths the length of first flagellar article; flagellum

<sup>2</sup> After J. C. Bridwell, who collected the type of this and other species described in this report.

simple, second segment four-fifths the length of first. Clypeus (fig. 16, *m*) finely punctulate, median length almost three-eighths (0.363) the vertical eye length; disc flatly tectate, bisected by a low keel which ends in the gently declivous, glabrous, polite, impunctate, low trigonal bevel of the median lobe, the apical margin of which is truncate medially, laterally on each side with two teeth.

Thorax subfulgid; with a thin vestiture of decumbent silvery puberulent hair, which is most noticeable on mesopleura. Pronotum short, anterior dorsal margin bluntly carinate except medially, humeri bluntly dentate, tubercles edentate; dorsal face traversed by a transverse foveolate furrow. Mesonotum and scutellum with coarse, scattered, variolate punctures throughout, the latter with lateral edges very weakly margined; postscutellum finely rugulose, simple, without laminae or lobes. Mesopleura coarsely rugosopunctate above to finely punctate below; metapleura with a few horizontal rugulae. Propodeum: Dorsal face with a row of large areoles radiating from anterior margin; posterior face with a broad, trigonal discal areole, laterad of which the surface is traversed by horizontal rugae; lateral carinae well developed below, obsolescent above, simple and not bifurcate below; lateral faces finely acupunctate.

Legs stout, simple. Fore metatarsi flattened, with a pecten of short, stiff spines. Middle and hind tibiae with outer faces spinulose. Longer hind tibial calcar eight-tenths the length of hind metatarsus.

Forewings with marginal cell about three times as long as broad and broadly truncate at apex; both radius and cubitus with second abscissae almost eight-tenths (0.78) the length of first abscissae.

Abdomen fulgid; with a thin vestiture of decumbent silvery puberulent hair. Tergites with fine scattered acupunctures and fine microscopic transverse aciculation; fifth tergite with puncturation slightly more distinct than preceding tergite; ultimate tergite with a broad, equilaterally trigonal pygidial area, the disc polite, with a few coarse punctures. Sternites with fine microscopic cancellate sculpture.

This Nigerian species is known from only the unique female described above.

ENCOPOGNATHUS (ENCOPOGNATHUS) RHODESIANA (Arnold)

*T[hyrcopus]* (*Encopognathus*) *chirindensis* Arnold, Occ. Pap. Rhodesian Mus., No. 1, p. 19, figs. 10, 10a, 1932 (♀, ♂; Southern Rhodesia; Spongweni).

*Encopognathus* (*Encopognathus*) *rhodesianus* PATE, Lloydia, vol. 6, p. 75, 1943.

The porrect lamelliform frontal tooth, the coarsely punctate first two segments of the immaculate black abdomen, and the carinate postscutellum distinguish this Southern Rhodesian form from all the other members of the *braueri* group.

## ENCOPOGNATHUS (ENCOPOGNATHUS) CHIRINDENSIS (Arnold)

*T[hyreopus]* (*Encopognathus*) *chirindensis* ARNOLD, Occ. Pap. Rhodesian Mus., No. 1, p. 17, figs. 11, 11a, 11b, 1932 (♀, ♂; Southern Rhodesia: Chirinda Forest, tunneling in a shady, sandy path).

*Encopognathus* (*Encopognathus*) *chirindensis* PATE, Lloydia, vol. 6, pp. 75, 76, 1943; ♀, ♂; Southern Rhodesia: Chirinda Forest; Mount Selinda).

The thick, opaque postscutellar lobes differentiate *chirindensis* from all other members of the *brownei* group. This is apparently one of the commonest species of the subgenus.

## ENCOPOGNATHUS (ENCOPOGNATHUS) BROWNEI (Turner)

*Encopognathus Brownei* TURNER, Ann. Mag. Nat. Hist., ser. 8, vol. 19, p. 106, 1917 (♀; Kenya: Tana River, 3,000 feet, near Mount Kenya).

*T[hyreopus]* (*Encopognathus*) *Brownei* ARNOLD, Ann. Transvaal Mus., vol. 11, p. 346, 1926; Ann. Transvaal Mus., vol. 12, p. 122, 1927 (*egregius* Arnold, 1926, placed as a synonym of *brownei* Turner, 1917).

*T[hyreopus]* (*Encopognathus*) *egregius* ARNOLD, Ann. Transvaal Mus., vol. 11, p. 347, figs. 4a, 4b, 1926 (♀; Southern Rhodesia: Sawmills; Rhodesdale, nesting in sandy banks).

*Encopognathus* (*Encopognathus*) *brownei* PATE, Lloydia, vol. 6, pp. 75, 76, 1943 (♀; Southern Rhodesia: Sanyati Valley).

This and the following two species have the postscutellum armed with a translucent lamella around the lateral and posterior margins. The coarsely punctate first three abdominal tergites immediately separates *brownei*, which ranges from Southern Rhodesia northward to Mount Kenya in east Africa, from both *granulata* and *acanthomerus*.

## ENCOPOGNATHUS (ENCOPOGNATHUS) GRANULATA (Arnold)

*T[hyreopus]* (*Encopognathus*) *granulatus* ARNOLD, Ann. Transvaal Mus., vol. 11, p. 348, 1926 (♀; Belgian Congo: Penge).

*Encopognathus* (*Encopognathus*) *granulatus* PATE, Lloydia, vol. 6, pp. 75, 76, 1943.

The fourth and fifth tergites of this species are covered with small, oval, warty granules. This type of sculpture is very distinctive and of rare occurrence in the sphecoïd wasps and serves to differentiate *granulata* from all other species of *Encopognathus*.

If all pemphilid wasps were to be placed in the single portmanteau genus *Crabro*, as Arnold proposes to do, the present species would require another name inasmuch as it would then be a homonym of the Egyptian *Crabro granulatus* Walker, 1871.

ENCOPOGNATHUS (ENCOPOGNATHUS) ACANTHOMERUS,<sup>3</sup> new species

FIGURE 16, b, j, n

The present Nigerian species is evidently most closely related to *granulata* but lacks the granular to finely pustulate sculpture on the

<sup>3</sup> ἀκανθα, spine + μῆρος, thigh; in allusion to the retrorsely spined fore femora of the males.

fourth and fifth abdominal tergites, which is such a characteristic feature of the Belgian Congo form. In addition, the fore femora of the males are armed beneath with a long retrorse spine and also have the antennal scape and pedicel very curiously modified.

*Type*.—Male; Oloke-Meji to Ibadan, Lagos, southern Nigeria. (J. C. Bridwell; U. S. N. M., No. 58034.)

*Male*.—Length 5 mm. Black; the following citrinous: Scapes save for a black spot behind; pronotal tubercles; fore femora with a narrow stripe above and a broad stripe lengthwise below; fore tibiae; middle tibiae on outer faces; hind tibiae with a broad stripe lengthwise on outer faces; all tarsi. Mandibles dark red. Fulvous: Fore femora save for yellow maculation; middle tibiae on inner faces; last two abdominal segments.

Head fulgid; clypeus with a silvery sericeous appressed pile; temples with a thin vestiture of decumbent puberulent silvery hair. Front with scapal area concave, shining, impunctate, inconspicuously and transversely strigose; upper front and vertex with coarse, irregular pits and punctures, which somewhat obscure the supraorbital foveae; ocelli in a low triangle, the ocellocular line three-fourths the postocellar distance; posterior orbits margined by a carinule, which is weakly foveolate anteriorly and which is continuous across vertex behind posterior ocelli; temples and area between postorbital and occipital carinules finely punctulate. Antennae (fig. 16, *b*) with scapes irregular, angulate before apex, almost one-half (0.45) the vertical eye length; pedicel two-thirds the length of first flagellar article, with a long lateral acuminate appendix; flagellum with first segment angularly widened below toward apex and twice the length of second segment; last segment twice the length of penult article; antennocular line one-half the interantennal distance. Clypeus (fig. 16, *n*) one-fourth the vertical eye length, finely punctulate, flat laterally to sharply tuberculate discally; with a polite, impunctate, glabrous, trigonal bevel from discal tubercle to apex of the sex-dentate median lobe. Mandibles with apices slender, acuminate; lower margins distinctly excised.

Thorax fulgid; with a thin and inconspicuous vestiture of puberulent silvery pubescence, which is most noticeable on epicnemium and lower mesopleura. Pronotum short, anterior margin transversely carinate, humeri and pronotal tubercles sharply dentate. Mesonotum with scattered, coarse, variolate pits and punctures; suture between mesonotum and scutellum deeply impressed; scutellum with coarse variolate punctures, lateral edges sharply margined; postscutellum with anterior margin arcuately carinate, surface concave, bisected by a carinule, lateral and posterior margins edged with a translucent, brownish, ecarinulate lamina, which is emarginate medioposteriorly. Meso-



pleura and metapleura with coarse, close, variolate punctures. Propodeum with dorsal and posterior faces coarsely areolate and sculptured; lateral carinae well developed, bifurcate below; lateral faces microscopically granulose.

Forelegs with femora (fig. 16, *j*) stoutly subfusiform, angulate distally below and armed with a long retrorse spine; tibiae flattened beneath; metatarsi distorted-laminate. Middle and hind legs simple, the tibiae echinulate on outer faces; longer hind tibial calcar one-half length of hind metatarsi.

Forewings with marginal cell three times as long as wide and broadly truncate at apex; radius with second abscissa eight-tenths the length of first abscissa; cubitus with first abscissa almost two-thirds (0.65) the length of second abscissa.

Abdomen fulgid; with a very inconspicuous vestiture of fine puberulent silvery hairs. Tergites almost impunctate but with fine microscopic transverse aciculation. Penult tergite with a few coarse scattered punctures; last tergite with a subtrapeziform pygidial area, the disc coarsely punctate. Sternites practically impunctate; hypopygium with apex entire.

*Allotype*.—Female; topotypical. Same data as type. (U. S. National Museum collection.)

*Female*.—Length 6 mm. The following features are solely those noteworthy of difference from those given in the foregoing description of the male (type):

Livery the same, but base of mandibles yellow.

Head with clypeal lobe essentially the same, the median clypeal length one-fourth the vertical eye length. Antennal scapes one-half the vertical eye length; simple, cylindrical, ecarinate; pedicel simple, obterete, four-fifths the length of the first flagellar article; flagellum simple, first two segments subequal in length, ultimate segment twice the length of penult article. Ocellocular line almost six-tenths (0.571) the postocellar distance.

Thorax and propodeum essentially the same; the pronotum with anterior margin more strongly carinate; humeri and pronotal tubercles more strongly dentate.

All legs simple. Fore metatarsi flattened, rather wide, and with a pecten of short stiff spines.

Abdomen generally as in male, but pygidial area broad, equilaterally trigonal, the disc with a few coarse, scattered punctures. Second sternite medially with a sharp, transverse, arcuate ridge on each side of median line.

This distinctive Nigerian species is known only from the unique pair described above.



ARNOLDITA,<sup>4</sup> new genus

*Thyreopus* (*Tracheliodes*) [*nec* Morawitz] ARNOLD, Ann. Transvaal Mus., vol. 11, p. 349, 1926.

*Crabro* (species-group *Tracheliodes*) [*nec* Morawitz] ARNOLD, Ann. Transvaal Mus., vol. 20, p. 137, 1940; Occ. Pap. Nat. Mus. Southern Rhodesia, vol. 2, No. 2, p. 28, 1944.

*Genotype*.—*Thyreopus* (*Tracheliodes*) *perarmatus* Arnold, 1926 (= *Arnoldita perarmata* (Arnold)).

The three-segmented labial and six-segmented maxillary palpi differentiate *Arnoldita* from all other genera of pemphilidine wasps with the exception of *Tracheliodes* and *Enoplolindenius*. From both of these, the present genus may be distinguished by its slender, elongate, clavate abdomen, the well-developed sternauli and hypersternauli on the mesopleura, the porrect frontal process, and the 11-segmented antennae of the males. In addition, the transversely carinate pronotum, the vertical carina on the mesopleura before the middle coxae, the strongly flanged and foveolate occipital carina, and the carinate antennal scapes separate *Arnoldita* from *Tracheliodes*; while the rounded, ecarinate mesosternum, the incompletely margined scapal sinus, the incomplete occipital carinule, and the protean-shaped mandibles distinguish the present genus from the New World entity *Enoplolindenius*.

*Generic characters*.—Small, slender, fulgid, impunctate or at best finely punctate forms. Head broad, transversely subrectangular in both anterior and dorsal aspects; eyes naked, very large and broad below, which more coarsely faceted anteriorly than posteriorly, inner orbits either strongly convergent below or more or less arcuate; malar space wanting. Front on anterior vertical aspect generally narrow, and with a rather deep, incompletely marginate scapal sinus bisected by a longitudinal carinule from which arises just above antennal sockets one, or rarely two, large, porrect, protean-shaped processes. Vertex flat, nitidous, generally impunctate; supraorbital foveae present and generally distinct; ocelli moderately large, arranged in an equilateral triangle. Temples very well developed, ecarinate, but posterior orbits either paralleled or not by a marginate groove; occipital carina very well developed, strongly flanged, foveolate anteriorly, but neither a complete circle in extent nor attaining the hypostomal carinule bordering the broad, shallow, scyphate oral fossa. Antennae situated low on face on dorsal margin of clypeus, the sockets contiguous to each other and either contiguous to, or well separated from, the nearest lower inner orbits; 12-segmented in the females, and with only eleven apparent segments in the known males; scape slender,

<sup>4</sup>It gives me great pleasure to dedicate this distinctive genus to Dr. George Arnold, director of the National Museum of Southern Rhodesia, in recognition of his outstanding work on the aculeate Hymenoptera of Africa.

elongate, unicarinate lengthwise; flagellum generally simple in females, but in males with the first three segments apparently ankylosed. Clypeus reduced laterally to a mere line, medially with a very short lobe which is diversely dentate or excised apically. Maxillary palpi with six, labial palpi with three, segments. Mandibles slender, very elongate, strongly decussate; apices either simple and acuminate, bidentate or truncate; inner margins dentate or edentate; lower margins entire. Females without a psammophore.

Thorax compact, perfulgid, finely punctate at most. Pronotum relatively elongate, transverse, anterior dorsal margin furnished with a sharp, transverse carina which descends vertically at the humeri; the dorsal surface with a transverse torus and frequently with a row of large foveae. Mesonotum polite, impunctate, though sometimes with pits or foveae anteriorly; suture between mesonotum and scutellum foveolate; axillae small, lateral margins rounded; scutellum polite; postscutellum short, transversely linear, longitudinally striate. Mesopleura more or less horizontally striate, generally impunctate; prepectus sharply margined anteriorly; episternal suture, hypersternauli, and sternauli present, well developed and strongly foveate, and a vertical carina before the middle coxae. Metapleura finely sculptured. Mesosternum rounded, ecarinate anteriorly. Propodeum fulgid; dorsal face with a more or less well defined trigonal enclosure; lateral carinae present and well developed along posterior and dorsal faces; posterior face with a discal areole.

Forewing with marginal cell narrow and elongate, four times as long as wide, truncate at apex and with a small appendiculate cell; radial vein with first abscissa one-half the length of second abscissa; transverse cubital vein oblique, inclivous, one-third the length of second abscissa of cubitus; cubitus with first abscissa two-thirds the length of second abscissa and somewhat angled backward at point of reception of recurrent vein. Hind wing with anal lobe distinctly shorter than the short submedian cell.

Legs simple or variously modified. Fore trochanters slender, obterete, about one-half the length of fore femora. Middle tibiae with a calcar in both sexes.

Abdomen slender, elongate, clavate; nitidous, immaculate black, and impunctate or at best very finely punctate. First segment elongate, petioliform and more or less nodose at apex. Tergites with basal acarid chambers, the ultimate in the females with a fully marginate pygidial area, which is more or less narrowed and excavate apically, the disc shallowly concave, the lateral margins glabrous. Males probably without a distinct pygidial area.

*Remarks.*—Although Arnold has recognized the discreteness of the present group, he has consistently assigned the component species to the

Holarctic genus *Tracheliodes*. But as I have pointed out in my review of that myrmecotherous entity,<sup>5</sup> *Arnoldita* has little in common with *Tracheliodes* save the same number of segments in the labial palpi. The strongly flanged and foveolate occipital carina, the transversely carinate pronotum, the sharply margined prepectus, the presence on the mesopleura of a vertical carina before the middle coxae and of well-developed sternauli and hypersternauli, the well-developed lateral carinae on the propodeum, and finally the slender, elongate, clavate abdomen of which the first segment is petioliform and more or less nodose apically, all indicate that these African species cannot be placed in *Tracheliodes* without doing violence to recognized generic concepts. Instead, as predicted elsewhere,<sup>6</sup> these features attest the close relationship that *Arnoldita* bears to the *Foxita* complex, of which it may be considered a highly specialized and aberrant member.

*Ethology*.—Like the majority of the members of the *Foxita* complex, the species of *Arnoldita* are xyloecetes. Arnold states that *A. senex* was bred from the abandoned burrows made by bostrychid beetles in an old wooden post at Helenvale, near Bulawayo, Southern Rhodesia.<sup>7</sup> All the species of *Arnoldita* have a relatively large, much thickened head, with the face strikingly broad below, and the mandibles extraordinarily large and well developed. This peculiarity is evidently correlated in some manner with the biology of these wasps: The mandibles are probably used either for excavating the burrows in wood or pithy stems, or, as in *Tracheliodes*, for seizing and carrying the prey back to the nest.

*Distribution*.—The genus *Arnoldita* is an entity restricted to the Ethiopian Region. At present three species are known: the Southern Rhodesian forms *senex* and *canalifera*, and *perarmata* which ranges from the northern portion of the Belgian Congo to Nigeria. The following key will serve to differentiate these forms:

#### KEY TO THE SPECIES OF ARNOLDITA

1. Fore femora armed below with a median tooth; antennal sockets contiguous to nearest lower inner orbit; mesonotum with two small pits anteriorly; mandibular apices obliquely truncate, the inner margins with a large preapical tooth; front with a porrect spatulate horn, the lateral margins of which are reflexed and the apex emarginate (Belgian Congo to Nigeria).  

perarmata (Arnold)
- Fore femora edentate below; antennal sockets relatively remote from nearest lower inner orbit; mesonotum without two pitlike foveae anteriorly (South African forms)----- 2
2. Mandibular apices truncate, inner margins edentate; mesonotum simple, not bisected anteriorly by a carinule; front with two porrect median processes; clypeus quinque-dentate-----senex (Arnold)

<sup>5</sup> Lloydia, vol. 5, pp. 230-231, 1942.

<sup>6</sup> Rev. Ent. (Rio de Janeiro), vol. 13, pp. 389-390, 1942.

<sup>7</sup> Ann. Transvaal Mus., vol. 11, p. 352, 1926.

Mandibular apices bidentate, the inner margins with a large tooth on basal third; mesonotum bisected anteriorly by a carinule; front with a single, porrect, spatulate process; clypeus quadridentate, the two median teeth broad and obliquely truncate-----canalifera (Arnold)

ARNOLDITA PERARMATA (Arnold)

FIGURE 16, *i, l*

*T[hyrcopus] (Tracheliodes) perarmatus* ARNOLD, Ann. Transvaal Mus., vol. 11, p. 349, figs. 5, 5a-d, 1926 (♀; Moho, near Lesse, Belgian Congo. Type in Congo-Museum, Tervueren, Belgium).

The dentate lower margins of the fore femora and the position of the antennal sockets in relation to the nearest lower inner orbits distinguish *perarmata* from the following two species.

I have examined three female specimens of *perarmata* in the collection of the United States National Museum, taken by J. C. Bridwell between Oloke-Meji and Ibadan, Lagos, southern Nigeria.

ARNOLDITA CANALIFERA (Arnold)

FIGURE 16, *d, g*

*Orabro* [species-group *Tracheliodes*] *canaliferus* ARNOLD, Occ. Pap. Nat. Mus. Southern Rhodesia, vol. 2, No. 2, p. 28, figs. 29, 29a-b 1944 (♀; Bulawayo, Southern Rhodesia. Type in Stevenson collection).

This species is evidently somewhat intermediate between *perarmata* and *senex*. Like *perarmata*, the front of *canalifera* is armed with a spatulate frontal horn but the simple unarmed fore femora readily separate it from that species. The much larger size and differently shaped clypeus distinguish *canalifera* at once from both *senex* and *perarmata*.

ARNOLDITA SENEX (Arnold)

FIGURE 16, *a, c*

*T[hyrcopus] (Tracheliodes) senex* ARNOLD, Ann. Transvaal Mus., vol. 11, p. 350, figs. 6, 6a, 1926 (♂; bred from abandoned burrows of bostrychid beetles in wooden post; Helenvale, near Bulawayo, Southern Rhodesia. Type in National Museum of Southern Rhodesia).

*O[rabro]* (species-group *Tracheliodes*) *senex* ARNOLD, Ann. Transvaal Mus., vol. 20, p. 137, fig. 27, 1940 (Southern Rhodesia: ♀, Lupane; ♂, Khamis).

The present species is readily distinguished from the other members of *Arnoldita* by the presence of two frontal horns or processes. These differ in the sexes: in the female the upper one is lamelliform but not spatulate in dorsal aspect and is angularly excised at base, while the lower one is subconical, shorter, and less porrect than that of the male; in the male the upper process is spatulate and the lower one strongly compressed on the lower half. The mandibular apices of the male are

simple and acuminate whereas those of the female are truncate. The structure of the clypeus likewise differs in the sexes.

### Genus *LESTICA* Billberg

#### *LESTICA DASYMERUS*,<sup>8</sup> new species

FIGURE 16, *e, f, h, k, o*

The peculiar conformation of the legs, particularly the fore and middle pair, readily differentiates *dasymerus* from all other species of the *Ceratocolus* section of the nominate subgenus of *Lestica*.

*Type*.—Male; Oloke-Meji to Ibaden, Lagos, Southern Nigeria. (J. C. Bridwell; U. S. N. M. No. 58035.)

*Male*.—Length 7 mm. Black; the following badeous: Mandibles save for red apices; pedicel; flagellar segments beneath; all trochanters and tarsi; fore tibiae with a line along posterior margins; middle femora and tibiae on inner faces; apical abdominal sternites. Citrinous: Antennal scapes anteriorly; pronotum with a transverse stripe broadly interrupted medially; pronotal tubercles; scutellum; first four abdominal tergites with a small spot laterally on each side; fore femora and tibiae; middle femora with a broad stripe lengthwise above and below; middle tibiae on outer faces. Wings tinged with fuscous; veins and stigma very dark brunneous.

Head opaque; subtrapeziform in anterior aspect, subquadrate in dorsal aspect; clypeus, and a narrow stripe along inner orbits, silvery pubescent; lower temples with a sparse vestiture of silvery puberulent hair. Front with scapal area deeply concave, finely microscopically punctulate; upper front and vertex with large, coarse, irregular, close, variolate pits and punctures; supraorbital foveae distinct, elongate, linear, cicatrose; ocelli arranged in a subequilateral triangle, the ocellocular line four-fifths the postocellar distance; occipital carina very well developed, strongly flanged, shallowly but distinctly foveolate anteriorly, attaining the posterior angles of the oral fossa, the hypostomal carinule obtusely lobed along posterior margin. Temples variolately pitted above, finely punctulate below. Antennae with scapes about one-half (0.52) the vertical eye length, obterete, ecarinate lengthwise; pedicel suborcate, two-fifths the length of first flagellar article; flagellum slender, elongate, with an inconspicuous fringe of short silvery hairs beneath along the tyloides, second segment nine-tenths length of first article, penult segment two-thirds length of last article. Clypeus (fig. 16, *h*) with median length one-third the vertical eye length; flatly tectate; bisected by a distinct keel which terminates in a small deflexed, polite, glabrous bevel at the apex of the produced median lobe. Mandibles strongly incurved apically; apices evenly bidentate; inner margins with a low obtuse tooth.

<sup>8</sup> *δασύς*, shaggy hair + *μυρός*, thigh; in allusion to the band of long shaggy hair on the fore femora.

Thorax opaque; with a thin vestiture of puberulent silvery hair which is most noticeable on lower half of mesopleura. Pronotum (fig. 16, *k*) with anterior and lateral margins sharply carinate, the humeri acutely angulate and projecting forward; dorsal surface coarsely, variolately sculptured. Mesonotum coarsely, closely, variolately pitted throughout; axillae sharply margined laterally; scutellum flat, coarsely, closely, variolately pitted throughout, lateral edges margined; postscutellum longitudinally rugulose. Mesopleura coarsely, variolately sculptured above to finely punctulate on lower third. Metapleura coarsely, longitudinally rugulate. Propodeum with large, coarse areoles on dorsal and posterior faces, the latter with a large, broad, subcuneate areole discally; lateral carinae well developed; lateral faces traversed by well-separated horizontal rugae.

Forelegs (fig. 16, *e, o*) with femora subtriquetrous and with a basal lobe projecting back beyond insertion of trochanter, lower outer edge sharply carinate, with a row of long white hairs near upper edge; tibiae subtriquetrous; tarsi distorted, without a pecten, second segment with a long appendix. Middle legs (fig. 16, *f*): coxae and trochanters with a brush of hair beneath; femora stoutly fusiform, keeled beneath at base and apex; tibiae irregularly subtriquetrous; metatarsi irregularly flattened, their anterior margin closely spinulate. Hind legs with coxae and trochanters villous beneath; femora stoutly subfusiform, finely rugulate and with a fine, irregular carinule below; tibiae stoutly obterete, the outer faces echinulate; metatarsi strongly compressed, elongate, three-fourths the length of tibiae and twice the length of the four distal segments combined; longer hind tibial calcar two-thirds the length of hind metatarsi.

Forewings with marginal cell elongate, narrow, four times as long as wide, broadly and squarely truncate at apex; radius with first abscissa five-eighths the length of second abscissa; transverse cubital vein one and a fourth times the length of second abscissa of cubitus which is one-fourth the length of first abscissa of cubitus.

Abdomen fulgid; compactly elongate-ovate; strongly constricted between the second, third, and fourth tergites; with a fine, thin vestiture of silvery puberulent hair. First three tergites coarsely, closely punctate save for a narrow transverse band of finer closer punctures just before the beaded caudal margins; fourth tergite rather coarsely punctate on basal two-thirds; remaining tergites finely punctulate; ultimate tergite short, transverse, almost impunctate, without a pygidial area, not bisected by a sulcus, the apical margin sinuate laterally on each side. Sternites finely, microscopically punctulate.

This distinctive species is known only from the unique male described above.



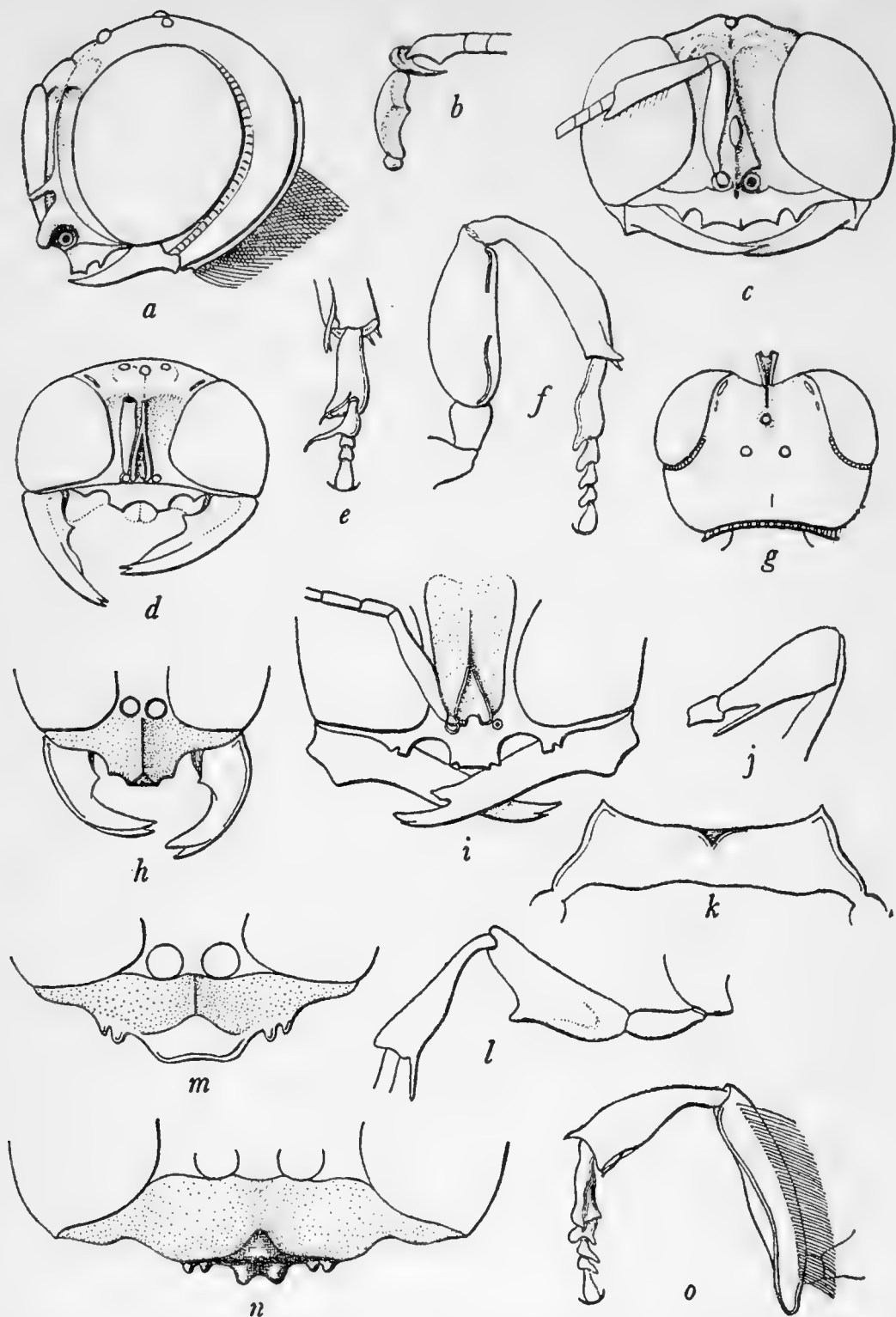


FIGURE 16.—*a*, *Arnoldita senex* (Arnold): Anterolateral aspect of head; *b*, *Encopognathus* (*E.*) *acanthomerus*, new species: Scape and basal flagellar articles; *c*, *Arnoldita senex* (Arnold): Anterior aspect of head; *d*, *A. canalifera* (Arnold): Anterior aspect of head; *e*, *Lestica dasymerus*, new species: Anterior aspect of fore tarsus; *f*, *L. dasymerus*: Posterior aspect of middle leg; *g*, *Arnoldita canalifera* (Arnold): Dorsal aspect of head; *h*, *Lestica dasymerus*, new species: Anterior aspect of clypeal region of head; *i*, *Arnoldita perarmata* (Arnold): Anterior aspect of lower portion of head; *j*, *Encopognathus* (*E.*) *acanthomerus*, new species: Lateral aspect of fore femur; *k*, *Lestica dasymerus*, new species: Dorsal aspect of pronotum; *l*, *Arnoldita perarmata* (Arnold): Lateral aspect of foreleg; *m*, *Encopognathus* (*E.*) *bridwelli*, new species: Anterior aspect of clypeal region of head; *n*, *E. (E.) acanthomerus*, new species: Anterior aspect of head of male; *o*, *Lestica dasymerus*, new species: Outer lateral aspect of foreleg.



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## THE BUTTERFLIES OF THE ADMIRALTY ISLANDS

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By WARREN HERBERT WAGNER, Jr., and DAVID F. GRETHIER

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AT THE suggestion and with the encouragement of Austin H. Clark, of the United States National Museum, we made a joint collection of about 200 butterflies while we were in the Admiralty Islands, the species represented including a number of new records for the group. The collection was made while we were flying with the Naval Air Transport Service during lay-overs at Momote Airstrip on Los Negros Island late in 1944 and in 1945; on Manus in May, November, and December 1945; and on Lou Island in the middle of November 1945. There are no published records of any species from either Los Negros or Lou Islands, or from the interior of Manus.

The Admiralty Islands are located west of New Ireland and northwest of New Britain in the Bismarck Archipelago at approximately latitude  $2^{\circ}$  S. and longitude  $147^{\circ}$  to  $148^{\circ}$  E. There are numerous small islands in the group clustering closely about the main island of Manus, which is 55 miles long by 16 wide and lies east and west. The highest altitude on Manus is 2,359 feet. All the islands are heavily forested except where they have been burned over or cleared by man for coconut groves and villages. Los Negros is a small coral island just to the east of Manus from which it is separated by a narrow channel.

Until about three decades ago the natives of the Admiralty Islands were so hostile to strangers that few collections had been made there. The *Challenger* expedition obtained a few specimens of a single species

in 1875, and Captain Webster secured a few more in 1897. Captain Webster was not able to land on the main island and collected only for two days on the small island of St. Gabriel or Paak when he was obliged to flee in his small schooner. W. Niepelt received representatives of nine species from the Admiralties about 1913. The only large and representative collection from this region was that made by A. S. Meek on Manus in November and December 1913. This collection was sent to the Tring Museum. From the Webster and Meek collections Lord Rothschild recorded a total of 53 species. Of these, 20 were not found by us, but this deficiency is amply compensated in our series by 16 species not previously known from the islands. There are now known from this region 69 species.

Butterflies do not seem to be common in the Admiralties. Here we found them much less conspicuous than in Guadalcanal, Biak, Sámar, or Guam. This is probably due to the occurrence of most of them in the forest and second-growth woods. In open fields there are so few species that are common that it seems worth while to list them—*Precis vellida bismarkiana*, *Danaus plexippus* (introduced from North America), *Zizula gaika*, *Zizera labradus*, *Catachrysops cnejus*, *Nacaduba ancyra*, *Catopsilia crocale*, *Baoris mathias*, *B. laraca*, *B. bevanii*, *Ocybadistes marnas*, and *Cephrenes moseleyi moseleyi*. Many of the forest species are conspicuous enough but fly so high in the trees or fly so swiftly that they are nearly unobtainable. One of these, *Papilio codrus auratus*, was so active and high-flying that we were unable to capture one, although we chased an individual for a half mile in a jeep along a road hoping that it might come within reach. Other species have a secretive flight in the forest undergrowth and are not noticed unless sought for. We were told by others who had caught brightly colored but high-flying forest species like *Papilio priamus admiralitatis* and *P. ulysses gabrielis* that early morning was the best time to collect them. The following species are represented in the collections from the Admiralties by single specimens: *Atella alcippe denosa*, *Syntarucus manusi*, *Nacaduba berenice*, *N. hermus*, and *Bindahara phocides*.

The fact that we obtained 16 species that Rothschild's collectors did not find, and that they secured 20 that we did not get, suggests that there is still much to be learned about the species of butterflies of this group of islands and their occurrence. Butterflies here are apparently quite peculiar, as a survey of endemism will show. As far as we can determine, 8 species and 22 subspecies are known only from the Admiralties—these taken together giving a total of 44 percent endemism. The figure is probably too high, but it is indicative of the

unusually interesting butterfly fauna of the Admiralties, and should encourage further study.

An interesting feature of the butterflies of these islands is that a number of the local subspecies show a tendency toward darkness in the restriction of light markings, the enlargement of dark markings, and the deepening of the ground color. This is illustrated by *Papilio ulysses gabrielis*, *Mycalesis perseus subpersa*, *Euploea callithoë admiralia*, *Hypolimnas pithoëca gretheri*, *Yoma algina manusi*, and other dark subspecies found elsewhere, such as *Taenaris phorcas uranus* and *Melanitis leda dominans*. Fewer of the local subspecies are characterized by an increase in light markings, as for instance *Parthenos sylvia admiralia* and *Thysonotis dispar latifascia*.

From our experience we are led to believe that habits are often as characteristic of butterflies as their color pattern and morphology; so we have included in the following list brief statements on the occurrence and behavior of those species known to us in the field.

Without the assistance of Austin H. Clark this collection could not have been made or these notes prepared. We thank him for his many instructive letters to us while we were in the field and for the supervision later of our studies in Washington. We also acknowledge our indebtedness to the various Naval authorities who permitted us to make collections and to enter jungle areas for the purpose of scientific study. We wish to thank Ernest L. Bell for his kindness in identifying for us our specimens of *Baoris laraca* and *B. bevani*. Brigadier William H. Evans was so very good as to identify for us the specimens of *Cephrenes moseleyi moseleyi* and *C. m. shortlandica*, and N. D. Riley, keeper of entomology, British Museum (Natural History), most courteously sent us a list of the localities from which *C. m. moseleyi* is represented in the collections under his care.

All our specimens are now in the United States National Museum except for some duplicates that we presented to the South Australian Museum at Adelaide, South Australia, and a few others that we gave to the Bernice P. Bishop Museum in Honolulu.

There are in the National Museum nine specimens, representing as many species, which were collected at Lorengau, Manus, By Emil Bogen in 1944 and 1945. For the sake of completeness we have included these records with ours.

## ANNOTATED LIST OF SPECIES

## Family NYMPHALIDAE

## Subfamily SATYRINAE

## MELANITIS LEDA (Linnaeus)

*Papilio leda* LINNAEUS, *Systema naturae*, ed. 10, vol 1, p. 474, No. 102, 1758 (Asia).

*Melanitis leda dominans* FRUHSTORFER, *Entomol. Zeitschr.*, Stuttgart, vol. 22, p. 87, 1908 (Bismarck Archipelago).—ROTHSCHILD, *Nov. Zool.*, vol. 22, No. 2, p. 200, June 1915 (Manus).

*Record*.—One male of the form *dominans*, falls of the Lorengau River, Manus, November 9, 1945.

*Notes*.—Emil Bogen captured a large female at Lorengau on December 1, 1944, which is pale in color and approaches the form *salomonis*, through the spots on the underside of the hind wings are not so large.

Lord Rothschild recorded six specimens of the form *dominans* from Manus. The National Museum contains two specimens of *dominans* from Lunga, Guadalcanal, collected by James Paul Burke, who also took the form *salomonis* at the same locality.

We have seen the form *dominans* on Los Negros and also on Lou. In the Admiralty Islands it is frequent in open bamboo thickets and also in second growth areas in wooded stream valleys. During the day it is always to be found in shady places. It flies rapidly through the underbrush close to the ground, but the flight is usually for only a short distance—5 to 10 yards. It is wary and hard to approach, and we found it quite difficult to capture.

## MYCALESIS PERSEUS SUBPERSA Rothschild

## PLATE 11, FIGURES 7, 8

*Mycalesis subpersa* ROTHSCCHILD, *Nov. Zool.*, vol. 22, No. 2, p. 200, June 1915 (Manus).

*Records*.—Five males, Los Negros, March 31, November 27, 1945; eastern tip of Manus, May 11, 1945. Three females, Los Negros, March 19, 20, 1945; eastern tip of Manus, May 11, 1945.

*Notes*.—This form, described by Lord Rothschild as a species, is only a local variant of the widely distributed *M. perseus*. It is another example of the prevailing tendency toward dark coloration in the butterflies of the Admiralty Islands. The white line on the under-surface of the forewings in this subspecies becomes very obscure in some individuals.

In grassy fields and on the brushy edges of woods this butterfly is common to abundant. In a weedy coconut grove just east of Lorengau, Manus, it is exceedingly numerous. It flies low with a jerky flight for short distances among the grasses.

### Subfamily MORPHINAE

#### TAENARIS PHORCAS URANUS Staudinger

*Tenaris anableps uranus* STAUDINGER, Exot. Schmett., vol. 1, p. 200, 1888 (New Britain, by error, New Ireland).

*Taenaris phorcas uranus* ROTHSCHILD, Nov. Zool., vol. 22, No. 2, p. 201, June 1915 (Manus).

*Records.*—Five males, Los Negros, November 16, 1944, March 8, November 30, 1945. Four females, March 20, April 1, November 17, 21, 1945.

Emil Bogen captured a specimen at Lorengau, Manus, on October 1, 1945.

*Notes.*—Rothschild had eight specimens of this butterfly from Manus. Compared with the other subspecies of *T. phorcas* this one is very dark, and specimens from the Admiralty Islands average darker than those from the Bismarck Archipelago.

A conspicuous butterfly in the Admiralties, this species is most frequent in dry hilly woods. In flight the wings move rather slowly, but the insect is agile and is an adept at dodging through brush close to the ground. When flushed it usually flies for only a short distance and is easily caught.

### Subfamily NYMPHALINAE

#### PRECIS VELLIDA BISMARKIANA (B. Hagen)

*Junonia vellida* var. *bismarkiana* B. HAGEN, Jahresb. Nassauischen Ver. für Naturk., Jahrg. 49, p. 86, 1897 (Neupommern).

*Records.*—Five males, Los Negros, March 30, April 1, November 13, 16, 30, 1945. Five females, Los Negros, March 20, 30, April 1, November 16, 1945.

*Notes.*—This species has not previously been recorded from the Admiralty Islands. It is surprising that Rothschild received no specimens from this region.

This butterfly is common in dry open fields. Here it resembles its relatives in other parts of the world in its swift flight for rather short distances over the grass tops.

#### PRECIS HEDONIA ADMIRALITATIS Rothschild

*Precis hedonia admiralitatis* ROTHSCHILD, Nov. Zool., vol. 22, No. 2, p. 203, June 1915 (Manus).

*Records*.—Six males, Los Negros, March 31, April 1, November 16, 17, 1945. Two females, Los Negros, November 10, 15, 1945.

*Notes*.—This is a common species in the Admiralties. Its flight is rather low and rapid. In habits it resembles an *Hypolimnas* more than it does the ordinary field types of *Precis*. It is seen most frequently in brushy open woods and coconut groves.

**HYPOLIMNAS EUPLOEOIDES Rothschild**

**PLATE 12, FIGURES 15, 16**

*Hypolimnas euploeoides* ROTHSCHILD, Nov. Zool., vol. 22, No. 2, p. 205, June 1915 (Manus).

*Records*.—Two females, Los Negros, March 20, 1945; eastern tip of Manus, May 11, 1945.

*Notes*.—Our female from Los Negros has the dark brown of the hind wings shading into rusty in a broad marginal area. This remarkable mimic of a species of the genus *Euploea* is known only from the Admiralties. Lord Rothschild had a pair from Manus.

**HYPOLIMNAS PITHOECA GRETHERI A. H. Clark**

**PLATE 11, FIGURES 1, 2**

*Hypolimnas pithoea gretheri* A. H. CLARK, Proc. Biol. Soc. Washington, vol. 59, p. 119, Oct. 25, 1946 (Lou).

*Records*.—Two males, Lou Island, November 16, 1945.

*Notes*.—This species has not heretofore been recorded from the Admiralty Islands. It occurs in woods and brushy country and somewhat resembles *H. euploeoides* in its habits.

**HYPOLIMNAS ANTILOPE WAGNERI A. H. Clark**

**PLATE 11, FIGURES 3, 4.**

*Hypolimnas antilope wagneri* A. H. CLARK, Proc. Biol. Soc. Washington, vol. 59, p. 119, Oct. 25, 1946 (Los Negros; also Manus).

*Records*.—Three males, Los Negros, November 16, 1944, November 11, 1945; Drangot River, Manus, November 14, 1945.

*Notes*.—This species has not previously been reported from the Admiralties. We found it most frequent in dry woods along a dirt road at Momote Airfield, Los Negros. The males perch on roadside trees about 10 feet from the ground and when frightened quickly fly away.

**HYPOLIMNAS ALIMENA EREMITANA Strand**

*Hypolimnas alimena eremitana* STRAND, Lepidoptera Niepeltiana, pt. 1, p. 35, 1914; pt. 2, pl. 8, fig. 14, 1916 (Admiralty Islands).

*Hypolimnas alimena manusi* ROTHSCHILD, Nov. Zool., vol. 22, No. 2, p. 205, June 1915 (Manus).

*Record*.—One male, Los Negros, November 15, 1945.

*Notes*.—*Hypolimnas alimena eremitana* was described by Dr. Embrik Strand in 1914 from a single male from the Admiralty Islands. It was redescribed by Lord Rothschild under the name of *Hypolimnas alimena manusi* in 1915 on the basis of four males from Manus. Strand in 1916 figured his type specimen, which appears to be a female, not a male, and a representative of Rothschild's *H. a. manusi*.

Although we saw this species several times we were able to secure only one on Los Negros. It is rare in brushy second-growth woods and along woodland roads. This butterfly is active and difficult to capture. It is fond of sitting on sun-lit leaves and darting out after other butterflies.

#### HYPOLIMNAS BOLINA (Linnaeus)

*Papilio bolina* LINNAEUS, Mus. Ludov. Ulric., p. 295, 1764 (in Indiis).

*Hypolimnas bolina* ROTHSCHILD, Nov. Zool., vol. 22, No. 2, p. 206, June 1915 (Manus).

*Records*.—One male, Lou Island, November 13, 1945. Two females, November 16, 1944, March 20, 1945.

A male was captured by Emil Bogen at Lorengau, Manus, on December 1, 1944.

*Notes*.—Rothschild recorded 10 specimens of this common Pacific island butterfly from Manus. Our female collected in November 1944, is of the form *iphigenia*, but with the white band on the forewings narrower than usual and the orange patch larger. The one taken in March 1945 is of the form *aphrodite* with the band on the forewings metallic violet-blue and the large patch on the hind wings metallic blue-green. Admiralty Islands specimens are not so large as those from the Solomons or so small as those from the Polynesian islands. They are closer in size to those from the Solomons.

This extremely variable species is frequent in brushy second growth areas, especially in the vicinity of Lorengau, Manus. Here because of its larger size it is more noticeable when on the wing than it is on the Polynesian islands.

#### HYPOLIMNAS MISIPPUS (Linnaeus)

*Papilio misippus* LINNAEUS, Mus. Ludov. Ulric., p. 264, 1764 (in Indiis).

*Hypolimnas misippus* ROTHSCHILD, Nov. Zool., vol. 22, No. 2, p. 205, June 1915 (Manus).

*Notes*.—Rothschild recorded three females of the form *diocippus* from Manus. In our experience with this species on Biak Island we found it to be more a butterfly of the open fields than the other species of *Hypolimnas*.



## ERIBOEA PYRRHUS ADMIRALITATIS (Rothschild)

*Eulepis pyrrhus admiralitatis* ROTHSCILD, Nov. Zool., vol. 22, No. 2, p. 208, June 1915 (Manus).

*Notes.*—This subspecies was described by Lord Rothschild on the basis of six specimens from Manus. We did not see it.

## PARTHENOS SYLVIA ADMIRALIA Rothschild

## PLATE 12, FIGURES 13, 14

*Parthenos sylvia admiralia* ROTHSCILD, Nov. Zool., vol. 22, No. 2, p. 207, June 1915 (Manus).

*Records.*—One male, Los Negros, May 14, 1945. One female, Drangot River, Manus, November 14, 1945.

Emil Bogen took one specimen at Lorengau, Manus, on October 1, 1945.

*Notes.*—This subspecies differs from *P. s. couppii* in having much more extensive and pure white bands of patches on the forewings, and the whole under side is Nile blue.

This rather large pale gray butterfly is generally frequent on the islands we visited, and we saw it on the slopes of Mount Tjajiac in south central Manus. It was most common in brushy country along the Drangot River. Its flight is fast, and the insect usually flies along the borders of woods from 10 to 20 feet above ground. When in the air it appears that the wings during the short glides are depressed below the horizontal.

## YOMA ALGINA MANUSI Rothschild

## PLATE 12, FIGURES 19, 20

*Yoma algina manusi* ROTHSCILD, Nov. Zool., vol. 22, No. 2, p. 204, June 1915 (Manus).

*Records.*—One male, Los Negros, March 20, 1945. Two females, March 20, November 1945.

*Notes.*—Described by Rothschild from a single female from Manus, this form differs from related subspecies in its gigantic ocelli. A brief description of the male follows:

Forewing 38 mm. On the upper surface no apical spots. Yellow band nearly straight, 9 mm. wide at costa, narrowing to 7 mm. at upper end of cell, then gradually broadening to 10 mm. at lower border. Hindwing above, the band straight, 5 mm. wide at costa, soon becoming 7 mm., tapering only very slightly distally. Central portion of the interspace of both wings beyond the yellow band darker than the ground color, the dark areas with rounded distal ends. Beneath, the bands white and narrower than on the upper surface. Ground color olive gray, the portion proximal to the bands entirely unmarked. Be-

yond the bands a very large oval black spot in each interspace ringed with yellow and with a blue pupil, the pupil smaller in the two lowest of the forewing, largest on the first, second, and fourth from the apex of the forewing and on the two central ones on the hindwing.

This brilliant black and orange nymphalid frequents woodland roads, along which the males are sometimes quite common. It is an active insect with a swift flight and is usually hard to capture. The males are fond of resting on bushes along roads.

**CYNTHIA ARSINOE LEMINA** Ribbe

*Cynthia arsinoe* var. *lemina* RIBBE, Iris, vol. 11, p. 113, Aug. 10, 1898 (Neu-Mecklenburg).

*Records*.—Three males, Lou Island, November 16, 1945.

*Notes*.—No material for comparison is available in the National Museum, but judged from the description these specimens appear to be referable to this subspecies. Lord Rothschild did not receive this butterfly from the Admiralties, but he had representatives of other subspecies from Dampier and Vulcan Islands.

The vigor and activity of this species remind one of a South American *Prepona* or a large North American *Polygonia*. We found it common on the island of Lou where it is to be observed along the rocky coastal woods. On the occasions when individuals alight in sunny spots on the ground along paths an extremely slow approach must be made if the insect is not to be frightened. Ordinarily it flies high, well out of reach. The females are conspicuous because of their contrasting grayish and orange-brown coloration, but they seem to be quite uncommon and we were unable to secure one. We saw one female on Los Negros.

**VAGRANS SINHA ADMIRALIA** (Rothschild)

*Issoria sinha admiralia* ROTHSCCHILD, Nov. Zool., vol. 22, No. 2, p. 202, June 1915 (Manus).

*Note*.—Rothschild's five specimens of this endemic subspecies came from Manus. We did not find it.

**ATELLA ALCIPPE DENOSA** Fruhstorfer

*Atella alcippe denosa* FRUHSTORFER, in Seitz, Die Grossschmetterlinge der Erde, vol. 9, p. 473, Mar. 18, 1912 (Neu Pommern; Neu Lauenburg).

*Record*.—One male, falls of the Lorengau River, Manus, November 11, 1945.

*Notes*.—This subspecies has been tentatively identified from the description, there being no specimens available for comparison. The species has not previously been recorded from the Admiralty Islands.

This little orange-brown nymphalid is quite common in the forest along the upper Lorengau River, but it is very difficult to capture. It perches on the leaves of high branches of trees and is wary. When approached closely it flies away with a rapid flight about 15 feet from the ground. It seems to be confined to the shady woods along the river and we did not find it elsewhere.

CETHOSIA OBSCURA GABRIELIS Rothschild

*Cethosia gabrielis* ROTHSCHILD, Nov. Zool., vol. 5, No. 2, p. 218, May 1898 (St. Gabriel).

*Note*.—This subspecies is known only from the coral island of St. Gabriel or Paak, which lies about 10 nautical miles east of Manus.

CETHOSIA OBSCURA MANUSI Rothschild

PLATE 12, FIGURES 11, 12

*Cethosia obscura manusi* ROTHSCHILD, Nov. Zool., vol. 22, No. 2, p. 202, June 1915 (Manus).

*Records*.—Four males, Los Negros, November 21, 1945; Lorengau River, Manus, November 18, 1945. Two females, western Los Negros, November 16, 1944; Los Negros, November 28, 1945.

A specimen from Lorengau, Manus, was sent to the National Museum by Emil Bogen.

*Notes*.—On the basis of nine specimens from Manus Lord Rothschild described this subspecies as differing from the preceding in having smaller white spots on the forewings above, and below in having the black bands in the cell of the forewings much broader and the white subterminal spots smaller.

We have noticed that on the upper surface wherever the veins are exposed by the removal of the scales their color is red.

In wooded areas, especially in flat country along streams, this is a frequent species. The flight is of medium speed and follows a straight course, usually about 5 to 10 feet above the ground. The dominant blue-black color combined with the red markings beneath make this a rather conspicuous butterfly.

MIYANA MOLUCCANA FUMIGATA (Honrath)

*Acraca fumigata* HONRATH, Berliner Entomol. Zeitschr., vol. 30, Heft 1, p. 130, pl. 5, fig. 3, June 1886 (Neu-Pommern [=New Britain]).

*Records*.—Five females, Lou Island, November 16, 1945.

*Notes*.—This species has not been previously reported from the Admiralties.

We found this butterfly only along the coast of Lou Island where it is quite common along the wooded cliffs above the shore. It has a

slow flapping flight and is not very conspicuous. When flying it has a gray glossy appearance. The insects are easily captured, but they often fly among the lower branches of tall trees making them difficult to reach with the net.

### Subfamily DANAINAE

#### DANAUS JUVENTA RIBBEI (Fruhstorfer)

*Danaida juvena ribbei* FRUHSTORFER, Iris, vol. 19, p. 163, 1906 (New Ireland).—ROTHSCHILD, Nov. Zool., vol. 22, No. 2, p. 196, June 1915 (Manus).

*Records.*—Seven males, Los Negros, November 16, 1944, March 19, May 14, November 9, 1945; Manus, near Lorengau, November 9, 1945. Four females, Los Negros, November 16, 1944, May 14, November 15, 25, 1945.

*Notes.*—This is a common butterfly in weedy thickets and second growth woods. The flight is rather slow and weak as compared with that of the North American monarch.

#### DANAUS MYTILENE DECIPIENTIS (Strand)

*Danaida mytilene decipientis* STRAND, Lepidoptera Niepeltiana, pt. 1, p. 25, 1914 (Admiralty Islands).—ROTHSCHILD, Nov. Zool., vol. 22, No. 2, p. 196, June 1915 (Manus).

*Records.*—Six males, Los Negros, November 16, 1944, March 18, 19, November 9, 21, 1945. Six females, Los Negros, November 17, 1944, March 19, November 15, 17, 19, 27, 1945.

*Notes.*—Strand described this subspecies on the basis of one male from the Admiralty Islands. Rothschild had 8 specimens from Manus.

This butterfly is very common on Los Negros island, particularly about Momote Airfield, along roads, and in coconut groves. The flight is weak, at a level of about five feet from the ground.

#### DANAUS PLEXIPPUS PLEXIPPUS (Linnaeus)

*Papilio plexippus* LINNAEUS, Systema naturae, ed. 10, vol. 1, p. 471, No. 80, 1758 (North America).

*Records.*—Two males, Lorengau, Manus, December 1, 1945.

*Notes.*—Although heretofore not reported from the Admiralties, this widely spread introduced species is well known in the Bismarck Archipelago and in the Solomon Islands. It was found by Ribbe in New Pomerania, New Lauenburg, New Mecklenburg, Nusa, New Hanover, Shortland Island, Bougainville, Choiseul, Isabel, and New Georgia.

In the Admiralties it is frequent in fields near Mokerang Airstrip on Los Negros, and quite common in fields at Lorengau. The mon-

arch feeds in numbers on *Zinnia* in gardens at Lorengau. The larva very likely feeds on *Asclepias curassavica*, the orange milkweed, which is common, growing in open dryish fields and in coconut groves. The flight is swift and seems, peculiarly, to be faster than it is in the United States.

**EUPLOEA NOBILIS Strand**

*Euploea nobilis* STRAND, Lepidoptera Niepeltiana, pt. 1, p. 27, pl. 8, figs. 6, 7, 1914 (Admiralty Islands).—ROTHSCHILD, Nov. Zool., vol. 22, No. 2, p. 197, June 1915 (Manus).

*Euploea nobilis* ab. *simplicior* STRAND, Lepidoptera Niepeltiana, pt. 1, p. 27, pl. 8, fig. 10, 1914 (Admiralty Islands).—ROTHSCHILD, Nov. Zool., vol. 22, No. 2, p. 197, June 1915 (Manus).

*Records*.—Two males, Los Negros, November 21, 27, 1945.

*Notes*.—Our two specimens are of the variety *simplicior* Strand. Niepelt had four specimens from the Admiralties and Rothschild had eight from Manus, two of these being of the variety *simplicior*.

This is a frequent insect in shady damp woods and flies slowly about 10 feet above the ground.

**EUPLOEA SUBNOBILIS Strand**

*Euploea subnobilis* STRAND, Lepidoptera Niepeltiana, pt. 1, p. 27, pl. 8, fig. 9, 1914 (Admiralty Islands).—ROTHSCHILD, Nov. Zool., vol. 22, No. 2, p. 197, June 1915 (Manus).

*Note*.—This species is very similar to *E. nobilis*. It is apparently rare as Niepelt had but one and Rothschild only two specimens. We did not find it.

A male was collected by Emil Bogen at Lorengau, Manus, on April 1, 1945.

**EUPLOEA INSULICOLA Strand**

*Euploea insulicola* STRAND, Lepidoptera Niepeltiana, pt. 1, p. 28, pl. 8, figs. 4, 5, 1914 (Admiralty Islands).—ROTHSCHILD, Nov. Zool., vol. 22, No. 2, p. 197, June 1915 (Manus).

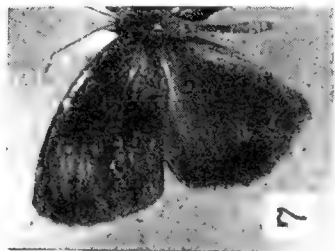
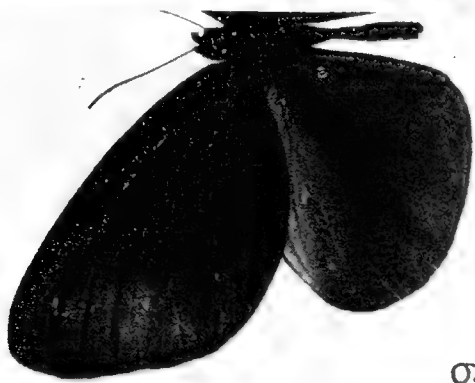
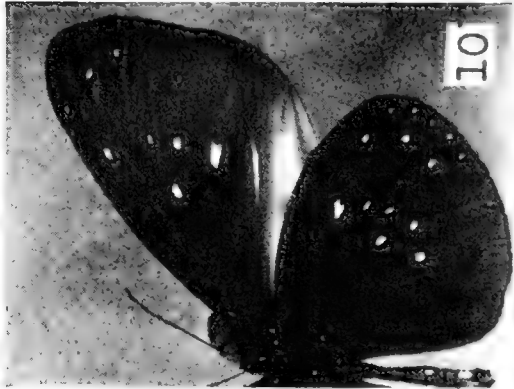
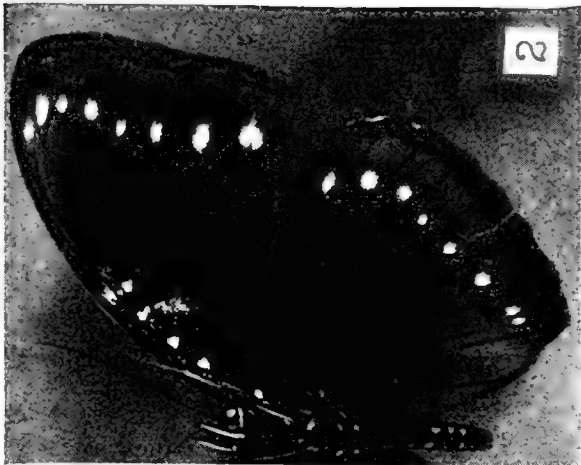
*Note*.—This species was received both by Niepelt and by Rothschild, but we failed to find it.

**EUPLOEA NEMERTES AFFINITA Strand**

*Euploea nemertes affinita* STRAND, Lepidoptera Niepeltiana, pt. 1, p. 28, pl. 8, fig. 11, 1914 (Admiralty Islands).—ROTHSCHILD, Nov. Zool., vol. 22, No. 2, p. 197, June 1915 (Manus).

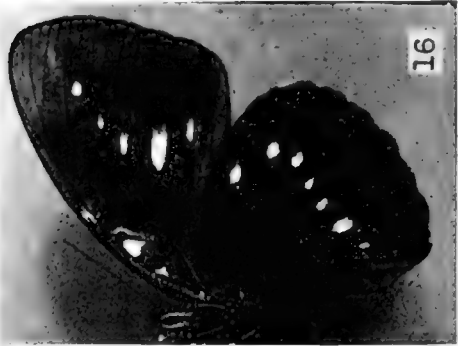
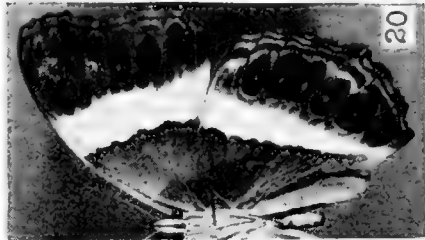
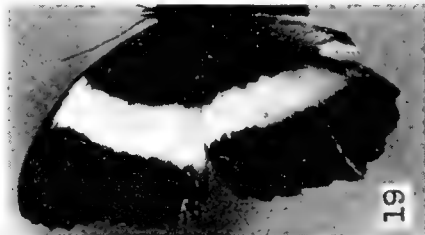
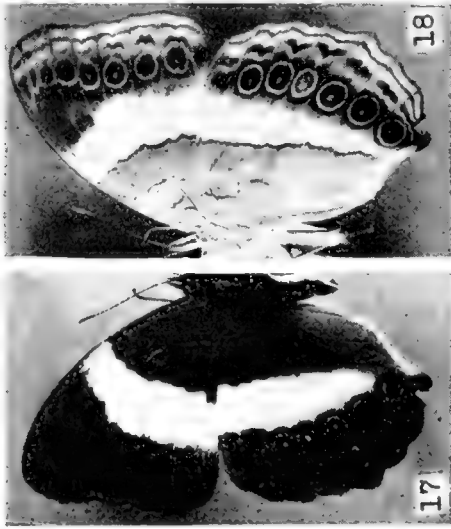
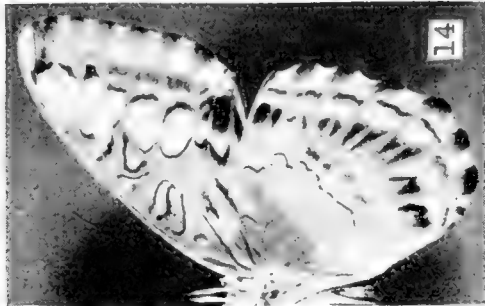
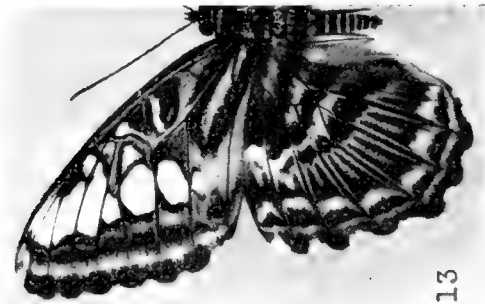
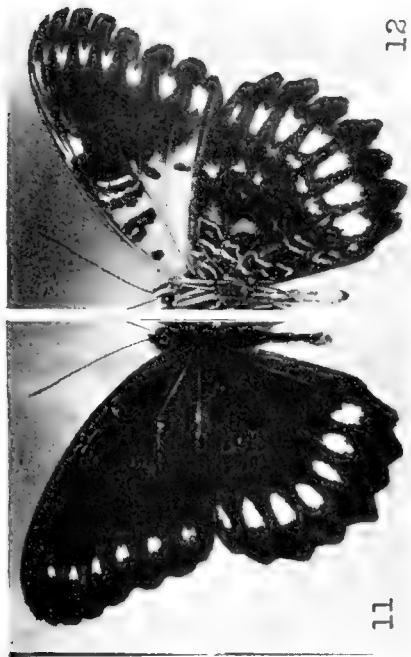
*Records*.—Four males, Los Negros, March 15, November 15, 21, 1945. Three females, Los Negros, March 15, 20, 1945; Manus, December 1, 1945.

*Notes*.—There is considerable variation in the size of the submarginal spots. In some of the specimens they are small, only the anterior three of the hind wing being present on the upper surface.



1, 2, *Hypolimnias pilhoeca gretheri*, male, Lou, Nov. 16, 1945; 3, 4, *Hypolimnias antilope wagneri*, male, Los Negros, Nov. 16, 1945; 5, 6, *Tagiades inconspicua*, Los Negros, Nov. 17, 1944; 7, 8, *Mycalesis perseus subpersa*, Los Negros, Mar. 31, 1945; 9, 10, *Euploea lewinii doretta*, male, Drangot River, Manus, Nov. 14, 1945. Natural size. [Odd numbers upper sides; even numbers under sides.]





11, 12, *Cethosia obscura manusi*, Los Negros, Nov. 21, 1945; 13, 14, *Parthenos sylvia admiralia*, Los Negros, Mar. 14, 1945; 15, 16, *Hypolimnna euploeoides*, Manus, May 11, 1945; 17, 18, *Yoma algina pavonia*, male, Guadalcanal, Solomon Islands, D. F. Grether, Mar. 14, 1945; 19, 20, *Y. a. manusi*, male, Los Negros, Mar. 20, 1945. About two-thirds natural size. [Odd numbers upper sides; even numbers under sides.]





21



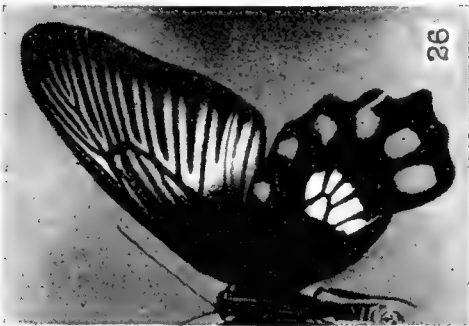
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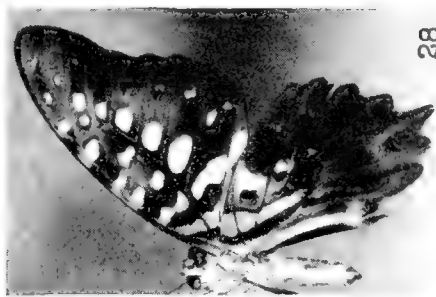
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21, 22, *Papilio weymeri*, male, Los Negros, May 14, 1945; 23, 24, *P. phestus reductus*, male, Lorengau River, Manus, Nov. 20, 1945; 25, 26, *P. polydorus manus*, male, Lou, Nov. 16, 1945; 27, 28, *P. agamemnon admiralis*, male, eastern tip of Manus, Nov. 11, 1945. About two-thirds natural size. [Odd numbers upper sides; even numbers under sides.]



In the female from Manus the forewing is only 34 mm. long; in the two others it is 44 and 45 mm. in length.

Like the other *Euploeas*, this is a woodland butterfly. It is frequent in rather open woods, particularly near Momote Field on Los Negros island. It flies slowly between 5 and 10 feet from the ground and is easily captured.

**EUPLOEA NEMERTOIDES Rothschild**

*Euploea nemertoides* ROTHSCHILD, Nov, Zool., vol. 22, No. 2, p. 197, June 1915 (Manus).

*Notes.*—Rothschild had ten specimens of this species from Manus. Judging from the description it is extremely close to the preceding form, with which it occurs.

**EUPLOEA CALLITHOE ADMIRALIA Strand**

*Euploea callithoe admiralia* STRAND, Lepidoptera Niepeltiana, pt. 1, p. 26, pl. 8, fig. 1, 1914 (Admiralty Islands).—ROTHSCHILD, Nov. Zool., vol. 22, No. 2, p. 198, June 1915 (Manus).

*Records.*—Two males, Los Negros, November 21, 27, 1945.

*Notes.*—Both Niepelt and Rothschild received specimens of this splendid butterfly. It is darker than the other subspecies of *E. callithoe* and is another example of the tendency toward darkness so marked in the butterflies of the Admiralty Islands.

When alive this largest of the local *Euploeas* is very brilliant, showing blue reflections in the sunlight. It is unusual in flying high among the forest trees, unlike the others of its genus here. In the morning and evening, however, it may be found at a lower height among small trees, and our specimens were taken at this time.

**EUPLOEA LEWINII DORETTA Pagenstecker**

**PLATE 11, FIGURES 9, 10**

*Euploea (Lontara) doretta* PAGENSTECKER, Jahrb. Nassauischen Ver. für Naturk., 1894, p. 72, No. 14 (Mioko, Neu-Lauenburg).

*Euploea doretta* PAGENSTECKER, Die Lepidopterenfauna des Bismark Archipels, pt. 1, p. 51, pl. 1, fig. 1, 1899.

*Record.*—One male, Drangot River, Manus, November 14, 1945.

*Notes.*—This is the first record of this species for the Admiralties. Our specimen was compared with some of Ribbe's original specimens from Mioko and New Pomerania and no differences were found. Pagenstecker's figure is said to represent a male but is evidently a female. Pagenstecker said that "according to C. Ribbe it is quite rare on New Lauenburg" whence it was described.

## EUPLOEA TREITSCHKEI URSULA (Butler)

*Saphara ursula* BUTLER, Ann. Mag. Nat. Hist., ser. 5, vol. 11, p. 407, 1883 (d'Entrecasteaux Island, Admiralty Islands).

*Euploea treitschkei ursula* ROTHSCILD, Nov. Zool., vol. 22, No. 2, p. 189, June 1915 (Manus).

*Records*.—Five males, Los Negros, November 16, 1944, March 18, November 11, 15, 1945. Five females, March 31, April 1, November 15, 16, 17, 1945.

The National Museum contains a specimen collected by Emil Bogen at Lorengau, Manus, on February 15, 1945.

*Notes*.—This subspecies was originally described from d'Entrecasteaux Island, Admiralty group. Rothschild received eight specimens from Manus.

We found this the commonest *Euploea* at Los Negros. It is especially frequent along the brushy edges of woods and is fond of flowers, particularly of those of the orange milkweed (*Asclepias curassavica*). It is easy to capture, its flight being slow and rather low.

## EUPLOEA PUMILA BISMARKIANA (Fruhstorfer)

*Calliploea engrammelli bismarkiana* FRUHSTORFER, Berliner Entomol. Zeitschr., vol. 45, p. 7, 1900 (New Britain).

*Euploea pumila bismarkiana* ROTHSCILD, Nov. Zool., vol. 22, No. 2, p. 198, June 1915 (Manus).

*Note*.—Rothschild had nine males of this form from Manus. We did not find it.

## Family LYCAENIDAE

## EUPSYCHELLUS DIONYSIUS (Boisduval)

*Lycaena dionysius* BOISDUVAL, Voy. *Astrolabe*, Lepidoptera, p. 82, No. 11, 1832 (New Guinea).

*Eupsychellus dionysius* ROTHSCILD, Nov. Zool., vol. 22, No. 3, p. 389, December 1915 (Manus).

*Records*.—Two males, Los Negros, March 18, 1945; Lou Island, November 16, 1945. Five females, Los Negros, November 11, 1945; Lou Island, November 16, 1945.

*Notes*.—Rothschild recorded a single specimen from Manus.

This little black and white lycaenid is not rare, and is sometimes locally common in woods. Its white color makes it noticeable in its low jerky flight through the shaded undergrowth. On Lou Island it was especially common in a rocky wooded ravine. It is easily captured.

## ZIZULA GAIKA (Trimen)

*Lycaena gaika* TRIMEN, Trans. Ent. Soc. London, ser. 3, vol. 1, p. 403, 1862 (South Africa).

*Zizera gaika* ROTHSCILD, Nov. Zool., vol. 22, No. 3, p. 389, December 1915 (Manus).

*Records*.—Four males, mangrove swamp, Los Negros, November 11, 1945. One female, same locality and date.

*Notes*.—This tiny butterfly is frequent on the brushy edges of fields, and we also found it locally abundant on the brushy side of a road through a mangrove swamp in western Los Negros. It is a very active little creature.

**ZIZERA LABRADUS (Godart)**

*Polyommatus labradus* GODART, Encyclop. méthodique, vol. 9, p. 680, No. 197, 1823 (Australia).

*Zizera labradus* ROTHSCILD, Nov. Zool., vol. 22, No. 3, p. 389, December 1915 (Manus).

*Records*.—One male, Los Negros, November 16, 1944. Two females, Los Negros, November 17, 1944, eastern tip of Manus, May 11, 1945.

*Notes*.—Lord Rothschild said that this species "varies enormously in size." Our specimens are all large, the male with the forewings 13 mm. in length, the females with the forewings 14 mm. They seem to be more blue than those in the National Museum, but this may be due to their freshness.

This species is frequent in brushy field at Momote Airstrip, Los Negros.

**SYNTARUCUS MANUSI Rothschild**

*Syntarucus manusi* ROTHSCILD, Nov. Zool., vol. 22, No. 3, p. 390, December 1915 (Manus).

*Note*.—This species was described from a single male from Manus. We did not find it.

**JAMIDES BOCHUS SOEMIAS Druce**

*Jamides soemias* DRUCE, Proc. Zool. Soc. London, 1891, p. 337, pl. 32, figs. 4, 5, June 2, 1891 (Solomon Islands: Alu, Fauro, Florida, and Malaita).

*Jamides saemias* ROTHSCILD, Nov. Zool., vol. 22, No. 3, p. 391, December 1915 (Manus).

*Records*.—One male, Los Negros, November 28, 1945. One female, eastern Manus, November 12, 1945.

*Notes*.—This species is frequent along the edges of woods. The brilliant blue of the male makes it a conspicuous insect when on the wing. Those we saw or collected were all in waist-high brush on the outskirts of the forest. The flight is faster than that of most lycaenids.

**JAMIDES UNIFORMIS Rothschild**

*Jamides uniformis* ROTHSCILD, Nov. Zool., vol. 22, No. 3, p. 391, December 1915 (Manus).

*Note*.—This species was described from one male and one female from Manus. We did not meet with it.

## CATACHRYSOPS CNEJUS (Fabricius)

*Hesperia cnejus* FABRICIUS, Ent. Syst. Suppl., p. 430, No. 100-101, 1798.

*Records*.—Four males, Los Negros, November 10, 1945. Two females, Los Negros, November 15, 1945.

*Notes*.—This species has not previously been recorded from the Admiralties. Lord Rothschild had specimens from Dampier and Vulcan Islands. It is an extremely variable butterfly. One of our males is slightly larger than the others with a more conspicuous black border on the upper surface and no anal spot. The anal spot beneath is without black.

This butterfly is rather common in fields.

## NACADUBA BERENICE (Herrich-Schaeffer)

*Lycaena berenice* HERRICH-SCHAEFFER, Stett. Entomol. Zeitschr., 1869, p. 74, No. 331 (Rockhampton).

*Nacaduba berenice* ROTHSCHILD, Nov. Zool., vol. 22, No. 3, p. 392, December 1915 (Manus).

*Note*.—Rothschild recorded one male from Manus.

## NACADUBA MEIRANGANUS (Röber)

*Plebejus meiranganus* ROBER, Iris, vol. 1, p. 65, pl. 5, figs. 23, 25, 1886 (Aru).

*Nacaduba meiranganus* ROTHSCHILD, Nov. Zool., vol. 22, No. 3, p. 392, December 1915 (Manus).

*Note*.—Rothschild had several specimens from Manus.

## NACADUBA KORENE Druce

*Nacaduba korene* DRUCE, Proc. Zool. Soc. London, 1891, p. 361, pl. 31, fig. 8 (Guadalcanar).—ROTHSCHILD, Nov. Zool., vol. 22, No. 3, p. 392, December 1915 (Manus).

*Note*.—Two females were recorded from Manus by Rothschild.

## NACADUBA NORA (Felder)

*Lycaena nora* FELDER, Sitzb. Akad. Wiss. Wien, math.-naturw. Cl., vol. 40, p. 458, No. 37, 1860 (Amboina).

*Nacaduba nora* ROTHSCHILD, Nov. Zool., vol. 22, No. 3, p. 392, December 1915 (Manus).

*Note*.—Several specimens were recorded from Manus by Rothschild.

## NACADUBA NORA (Felder)

*Lycaena hermus* FELDER, Sitzb. Akad. Wiss. Wien, math.-naturw. Cl., vol. 40, p. 457, No. 33, 1860 (Amboina).

*Nacaduba hermus* ROTHSCHILD, Nov. Zool., vol. 22, No. 3, p. 393, December 1915 (Manus).

*Note*.—One male was recorded from Manus by Rothschild.

## NACADUBA ANCYRA (Felder)

*Lycaena ancyra* FELDER, Sitzb. Akad. Wiss. Wien, math.-naturw. Cl., 1860, p. 458, No. 35 (Amboina).

*Records*.—Four males, Los Negros, November 18, 1944, March 30, 1945. One female, November 21, 1945.

*Notes*.—There is no previous record of this species from the Admiralties, but Rothschild had specimens from Vulcan and Dampier Islands. It is odd that the only *Nacaduba* that we found was not one of the five recorded by Rothschild.

This is a common butterfly of open fields at Momote Airstrip, Los Negros. The flight is low and resembles that of the other little meadow blues.

## THYSONOTIS HYMETUS MANUSI Rothschild

*Thysonotis hymetus manusi* ROTHSCHILD, Nov. Zool., vol. 22, No. 3, p. 394, December 1915 (Manus).

*Note*.—This subspecies was described from six specimens of both sexes from Manus.

## THYSONOTIS HAMILCAR Grose Smith

*Thysonotis hamilcar* GROSE SMITH, Ann. Mag. Nat. Hist., ser. 6, vol. 16, p. 25, 1894 (New Britain).—ROTHSCHILD, Nov. Zool., vol. 22, No. 3, p. 394, December 1915 (Manus).

*Note*.—Rothschild received nine specimens representing both sexes from Manus.

## THYSONOTIS DISPAR LATIFASCIA Rothschild

*Thysonotis dispar latifascia* ROTHSCHILD, Nov. Zool., vol. 22, No. 3, p. 394, December 1915 (Manus).

*Thysonotis subsuleima* STRAND, Lepidoptera Niepeltiana, pt. 2, p. 18 pl. 14 fig. 31, December 1916 (Admiralty Islands).

*Records*.—Four males, Los Negros, April 1, November 15, 21, 1945; eastern tip of Manus, November 9, 1945. Five females, Los Negros, November 16, 1944, April 1, March 20, 1945; Lorengau River, Manus, November 18, 1945.

*Notes*.—Strand's *Thysonotis subsuleima* from the Admiralty Islands was based upon a female of the form described under the name of *Thysonotis dispar latifascia* by Rothschild in the previous year.

The flight of this beautiful little butterfly is slow, but when frightened it makes off into the underbrush, dodging through the bushes with great agility.



## AMBLYPODIA THAMYRAS LATIMARGINATA (Strand)

*Arhopala micale latimarginata* STRAND, Archiv für Naturg., vol. 78A, p. 78, 1913 (New Guinea).

*Arhopala helius* ROTHSCILD, Nov. Zool., vol. 22, No. 3, p. 397, December 1915 (Manus).

*Records*.—One male, eastern Manus, November 19, 1945. Four females, Los Negros, November 11, 1945; eastern Manus, November 17, 1945.

*Notes*.—This subspecies was recorded from Manus by Rothschild under the name of *Arhopala helius*. Our specimens agree with others in the National Museum collection labeled "German New Guinea."

In shady forests, often along rocky streams, this flashy hairstreak is locally frequent. When a woodland spot is found where it occurs each visit will yield several specimens. It is usually seen resting, with wings closed, on large leaves of shrubs and large herbs. It is not very wary and may rather easily be approached and caught. The flight is direct, and the brilliant blue color of the upper surface flashes brightly.

## BINDAHARA PHOCIDES (Fabricius)

*Papilio phocides* FABRICIUS, Entomol. Syst., vol. 3, pt. 1, p. 282, No. 85, 1793 (Africa).

*Record*.—One female, Los Negros, March 18, 1945.

*Notes*.—This is the first record for the Admiralties.

Our only specimen of this widely ranging hairstreak was found in a clearing in dry open woods near Momote Airstrip.

## Family PIERIDAE

## EUREMA HECABE OETA (Fruhstorfer)

*Terias hecabe oeta* FRUHSTORFER, in Seitz, Die Grossschmetterlinge der Erde, vol. 9, p. 168, 1910 (New Guinea).—ROTHSCILD, Nov. Zool., vol. 22, No. 2, p. 196, June 1915 (Manus).

*Record*.—One male, Los Negros, March 31, 1945.

*Notes*.—This common and widely distributed little sulphur butterfly is frequent everywhere in brushy second-growth areas. It has a low zigzag flight.

## HUPHINA PERIMALE DOHERTYANA (Grose Smith)

*Belenois dohertyana* GROSE SMITH, Nov. Zool., vol. 1, pt. 1, p. 337, 1894 (Fergusson Island).

*Huphina pitys mithra* FRUHSTORFER, Berliner Entomol. Zeitung, vol. 48, p. 102, 1903 (Fergusson Island).

*Records*.—Two females, Los Negros, November 15, December 1, 1945.

*Notes*.—This is a new record for the Admiralty Islands.

This butterfly occurs very locally in woods along the coast of Los Negros island. Its habits are very similar to those of the species of *Appias* in other tropical places. The flight is very active, following an irregular course swiftly through the trees from ten to thirty feet from the ground. When the butterfly comes to a road it dives down from the trees and zigzags along the forest edge for 20 or more yards before it again flies up to the tops of the trees. It is fond of flowers.

**CATOPSILIA CROCALE (Cramer)**

*Papilio crocale* CRAMER, *Papillons exotiques*, vol. 1, p. 87, pl. 55, figs. C, D, 1775 (East Indies).

*Records*.—Three males, eastern Manus, May 11, 1945; Lorengau, Manus, December 1, 1945. Three females, Momote Field, Los Negros, November 29, 1945; Lorengau, Manus, December 1, 1945.

*Notes*.—There is no previous record of this butterfly from the Admiralties.

This butterfly is common along the roads at Mokerang Airfield on Los Negros, and especially at Lorengau, Manus. It is fond of the cultivated flowers, mainly zinnias, that are grown in gardens in Lorengau, and in these gardens it is sometimes abundant. It is a swift and powerful flier. When a storm approaches the butterflies hurriedly find a good-sized bush in which they hide for security.

**Family PAPILIONIDAE**

**PAPILIO PRIAMUS ADMIRALITATIS Rothschild**

*Papilio priamus admiralitatis* ROTHSCHILD, *Nov. Zool.*, vol. 22, No. 2, p. 192, June 1915 (Manus).

*Records*.—One male, Lou Island, November 16, 1945. Three females, Los Negros, November 16, 1944; Lorengau River, Manus, November 9, 1945.

*Notes*.—The metallic green of the male when viewed obliquely shows blue reflections.

The birdwing is most frequent in dry and rather open woods. It is not common, and is usually seen during the day flying among the forest trees at a height of 30 to 50 feet above ground. The females have a slower and more cumbersome flight than the males and may be caught more easily. The males usually remain high in the trees, while the females often may be found within ten feet of the ground. Early morning when the dew is still on the ground is the best time to get specimens because then they tend to fly lower and less actively than later in the day.

**PAPILIO POLYDORUS MANUS** Talbot

PLATE 13, FIGURES 25, 26

*Papilio polydorus utuancensis* ROTHSCILD, Nov. Zool., vol. 22, No. 2, p. 193, June 1915 (Manus).

*Papilio polydorus manus* TALBOT, Bull. Hill Mus., vol. 4, No. 3, p. 155, January 26, 1932 (Manus).

*Records.*—Two males, Los Negros, November 11, 1945; Lou Island, November 16, 1945. Two females, Los Negros, November 16, 1944, March 20, 1945.

*Notes.*—This is a common swallowtail in woods and brushy places in the Admiralties. Its flight is not fast and is usually within 5 feet of the ground, making it the easiest of the local swallowtails to capture.

**PAPILIO PHESTUS REDUCTUS** Rothschild

PLATE 13, FIGURES 23, 24

*Papilio phestus reductus* ROTHSCILD, Nov. Zool., vol. 22, No. 2, p. 193, June 1915 (Manus).

*Records.*—Two males, Los Negros, November 15, 1945; Lorengau River, Manus, November 20, 1945.

*Notes.*—This little black and white swallowtail flies in forested regions, especially along rocky stream valleys, and is most common along the upper branches of the Lorengau River. The flight is low and irregular, and swift, so that the butterfly is very hard to catch.

**PAPILIO WEYMERI** Niepelt

PLATE 13, FIGURES 21, 22

*Papilio weymeri* NIEPELT, Lepidoptera Niepeltiana, pt. 1, p. 53, pl. 11, fig. 1, 1914 (Admiralty Islands; description and figure of a female).—ROTHSCILD, Nov. Zool., vol. 22, No. 2, p. 194, June 1915 (Manus; brief description of a male).

*Records.*—Four males, Los Negros, March 20, May 14, November 11, 1945. One female, March 18, 1945.

A female in the National Museum was captured by Emil Bogen.

*Notes.*—Lord Rothchild's description of the male of this fine swallowtail was brief, so we amplify it here:

Underside: Spots on the forewing as above, but the three lowest somewhat smaller. Hind wing crossed by a curved band of spots continuing those of the forewing, somewhat smaller, slightly darker, deeply notched exteriorly, each with a narrow straight band of diffuse blue scales just beyond the outer end, strongest in the lowest three. Anal spot larger, occupying the entire interspace, broader than long, orange, the inner border sprinkled with light bluish scales.

In the woods this conspicuous swallowtail flies swiftly at an average level of about 10 feet from the ground, but when it reaches clearings, and along roads, it may fly higher. It is very fond of the flowers of tall forest species of the ginger family. It is frequent in all wooded areas.

**PAPILIO ULYSSES GABRIELIS** Rothschild

*Papilio ulysses gabrielis* ROTHSCHILD, Nov. Zool., vol. 5, No. 2, p. 217, May 1898 (St. Gabriel) ; vol. 22, No. 2, p. 194, June 1915 (Manus).

*Records.*—Three males, Los Negros, November 16, 1944, March 19, May 14, 1945. One female, eastern Manus, November 16, 1945.

*Notes.*—This is a notable very dark local race of a common and wide ranging swallowtail, originally described from the island of St. Gabriel or Paak. The blue areas of the wings are restricted in extent and the blue scales are mixed with black scales. The hind wing is longer than in the other subspecies, with wider tails.

The blue swallowtail is probably the most conspicuous butterfly in the Admiralty Islands. It flies high among the trees and may be seen along the edge of the forest coursing actively up and down over the tall vegetation. In certain places, especially along dirt roads and small streams, the males cover a definite "beat," flying back and forth over the same area. Although it is one of the commonest butterflies in the Admiralty Islands it is not easy to catch, because of its high flight. The only female we captured was taken on ginger flowers.

**PAPILIO CODRUS AURATUS** Rothschild

*Papilio codrus auratus* ROTHSCHILD, Nov. Zool., vol. 5, No. 2, p. 218, May 1898 (St. Gabriel) ; vol. 22, No. 2, p. 194, June 1915 (Manus).

*Notes.*—This subspecies was described from St. Gabriel and later was received by Rothschild from Manus. This is one species we never could capture. We saw it several times during November 1945, at Los Negros. The flight is high and powerful, with a peculiar bouncing motion.

**PAPILIO MACFARLANEI ADMIRALIS** Rothschild

*Papilio macfarlanci admiralis* ROTHSCHILD, Nov. Zool., vol. 22, No. 2, p. 195, June 1915 (Manus).

*Record.*—One female, Momote Field, Los Negros, November 21, 1945.

*Notes.*—This is an active high-flying swallowtail which occurs in forested areas. It seems to be much less common than *P. agamemnon*, which it resembles in life.

## PAPILIO AGAMEMNON ADMIRALIS Rothschild

## PLATE 13, FIGURES 27, 28

*Papilio agamemnon admiralis* ROTHSCHILD, Nov. Zool., vol. 22, No. 2, p. 195, June 1915 (Manus).

*Records.*—Three males, eastern tip of Manus, November 11, 1945; Manus, November 19, 20, 1945.

Emil Bogen captured a male at Lorengau, Manus, on January 1, 1945.

*Notes.*—This green-spotted swallowtail is frequent in forest areas, normally flying high among the trees. The flight is very swift and follows an irregular course along the tree tops, dropping quickly down along woodland roads to follow the tops of shrubs, but soon returning again to a great height.

## Family HESPERIIDAE

## TAGIADES INCONSPICUA Rothschild

## PLATE 11, FIGURES 5, 6

*Tagiades inconspicua* ROTHSCHILD, Nov. Zool., vol. 22, No. 3, p. 398, December 1915 (Manus).

*Records.*—Los Negros, November 17, 1944; Lou Island, November 16, 1945.

*Notes.*—Rothschild described this species on the basis of two males from Manus. The female has yet to be discovered. On the male taken on Los Negros, in addition to the characters given in Lord Rothschild's description, there are four large but obscure dark spots, one on each side of vein 4, the outer just above the outer end of the white border, the next on the other side of vein 4 near the border, the two others in the interspace above. On the fore wing there are two large obscure dark spots between veins 1 and 2 and 2 and 3, just beyond the middle of the wing.

This black-and-white skipper is occasional in brushy woods along the coast. It is fond of perching on sunny leaves about 12 feet up in forest clearings, darting out after blue swallowtails if they pass by. The flight of this skipper is very fast, but the white patch on the hind wings makes it easy to follow with the eye.

## HASORA HURAMA (Butler)

*Ismene hurama* BUTLER, Trans. Ent. Soc. London, 1870, p. 498 (North Australia).  
*Hasora hurama* ROTHSCHILD, Nov. Zool., vol. 22, No. 3, p. 399, December 1915 (Manus).

*Record.*—One male, Los Negros, November 16, 1945.

*Notes.*—We found this skipper most common in coastal swamps at the edge of a salt marsh. It is local and generally rare except in a

few favored places. It has an exploratory flight path in and around patches of brush on the edges of mangrove swamps. It is difficult to approach and when frightened makes off with a direct swift flight, so that it is hard to capture.

**BAORIS HASAROIDES** (Elwes and Edwards)

*Parnara hasaroides* ELWES and EDWARDS, Trans. Zool. Soc. London, vol. 14, p. 284, pl. 21, fig. 11, 1897 (Batchian; Halmahera).—ROTHSCHILD, Nov. Zool., vol. 22, No. 3, p. 399, December 1915 (Manus).

*Note*.—Rothschild had four males of this species from Manus. We did not find it.

**BAORIS LARACA** (Swinhoe)

*Caltois laraca* SWINHOO, Ann. Mag. Nat. Hist., ser. 7, vol. 20, p. 434, 1907 (Woodlark Island).

*Record*.—One specimen, Los Negros, November 10, 1945. This specimen was kindly identified for us by Ernest L. Bell.

**BAORIS BEVANI** (Moore)

*Hesperia bevani* MOORE, Proc. Zool. Soc. London, 1878, p. 688, June 1878 (Salween; Moulmain; also Calcutta).

*Records*.—Three specimens, Lorengau River, Manus, December 1, 1945. We have to thank Ernest L. Bell for the identification of these specimens.

**BAORIS PARVIMACULA** (Rothschild)

*Parnara parvimacula* ROTHSCCHILD, Nov. Zool., vol. 22, No. 3, p. 399, December 1915 (Manus).

*Note*.—This species was originally described from Manus by Lord Rothschild. We did not find it.

**OCYBADISTES MARNAS** (Felder)

*Pamphila marnas* FELDER, Sitzb. Akad. Wiss. Wien, math.-naturw. Cl., vol. 40, p. 462, No. 53, 1860 (Amboina).

*Ocybadistes marnas* ROTHSCCHILD, Nov. Zool., vol. 22, No. 2, p. 401, December 1915 (Manus).

*Records*.—Three males, Los Negros, November 17, 18, 1944, November 11, 1945. One female, March 30, 1945.

*Note*.—Lord Rothschild had but one damaged specimen from Manus.

We found this tiny yellow skipper frequent in grasslands, and especially in brushy coconut groves. The flight is rapid, but it flies only for short distances, alighting usually on a blade of grass and opening its wings.

## CEPHRENES MOSELEYI MOSELEYI (Butler)

*Pamphila moseleyi* BUTLER, Ann. Mag. Nat. Hist., ser. 5, vol. 8, p. 198, No. 50, 1884 (Ké Dulan).

*Records*.—One male, Los Negros, November 17, 1944. Two females, Los Negros, November 22, 1944, November 26, 1945.

*Notes*.—The female taken on Los Negros on November 26, 1945, was caught at night around lights.

We are deeply indebted to Brigadier William H. Evans for his courtesy in identifying this species for us. N. D. Riley informs us that the British Museum contains specimens from Tenimber, the Moluccas, Kei Islands, Aru Islands, New Guinea, Fergusson Island, Dampier Island, New Britain, and St. Mathias Island.

Brigadier Evans was so kind as to identify for us a specimen of *Cephrenes moseleyi shortlandica* (Swinhoe) from the British Solomon Islands.

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FLIES OF THE FAMILY STRATIOMYIDAE OF THE  
SOLOMON ISLANDS

By MAURICE T. JAMES

THE stratiomyid fauna (Diptera) of the Solomon Islands has been practically unknown until quite recent times. In 1936 Curran<sup>1</sup> described three species and recorded a fourth from the archipelago, and the following year Lindner<sup>2</sup> published what is to date the most comprehensive account of the occurrence of the family on these islands. The present paper is based largely on the collections made by C. O. Berg on Guadalcanal Island, supplemented by material collected on Guadalcanal, Bougainville, and other islands of the Solomons group by A. B. Gurney, W. G. Downs, Jean Laffoon, George E. Bohart, D. Eldon Beck, K. L. Knight, E. Reinschissel, and others. In this material I have been able to recognize all but three of the forms previously recorded or described from the Islands and have added 15 others, 13 of which are new to science. This paper is being published at this time for two reasons: To present a systematic account of a fauna that has become fairly well known, thanks to the work of the above-mentioned collectors; and to provide names for the use of Mr. Berg in his account of the biologies and immature stages of the Stratiomyidae of the Solomons.

- 1. Cross vein m-cu present (rarely punctiform), the last posterior vein (Cu<sub>1</sub>) consequently arising from the second basal cell..... 2
- Cross vein m-cu absent, all posterior veins distinctly arising from the discal cell..... 14

<sup>1</sup> Proc. California Acad. Sci., ser. 4, vol. 22, pp. 12-14, 1936.  
<sup>2</sup> Ann. Mag. Nat. Hist., ser. 10, vol. 20, pp. 370-394, 1937.

2. Flagellum of antenna elongated, consisting of 6 to 8 closely united segments, the last segment sometimes forming a short style, but never an arista (Stratiomyinae)----- 3
- Flagellum of antenna with the basal complex short and bearing a well-defined apical or subapical arista (Sarginae)----- 9
3. Flagellum of antenna 8-segmented, without a terminal style; abdomen, from dorsal view, almost circular in outline, metallic blue; wings uniformly infuscated-----*Cyphomyia marshalli* Lindner
- Flagellum of antenna 6-segmented, the penultimate segment very short, tapering, the last one forming a short style; abdomen distinctly longer than wide; wings not or but lightly infuscated----- 4
4. Mesonotum densely golden pollinose, with 2 prominent stripes of black pollen on the disc (males; females unknown)----- 5
- Mesonotum not golden pollinose; or if so with 3 narrow stripes of black pollen, the outer ones arcuate anteriorly, on the disc----- 6
5. Black mesonotal stripes not much broader than the golden one separating them; no black pollinose area on scutellum.

***Eulalia aureovestis*, new species**

Black mesonotal stripes 3 or more times as broad as the narrow golden stripe separating them, and extending onto the scutellum.

***Eulalia aureovestis subaurea*, new subspecies**

6. First and second segments of antenna each scarcely longer than wide----- 7
- First and second antennal segments each  $2\frac{1}{2}$  to 3 times as long as wide; vein r-m absent, the radial sector broadly bordering the discal cell----- 8
7. Vein r-m distinctly present, though short; vein  $M_1$  distinct almost to wing margin; abdomen largely black in both sexes.

***Eulalia maculata* (de Meijere)**

Vein r-m absent, the radial sector broadly bordering the discal cell; vein  $M_1$  distinct only at base; abdomen of female greenish yellow (male unknown)-----

***Eulalia boharti*, new species**

8. Eyes bare; mesonotum with dense golden or yellowish tomentum interrupted by black stripes-----

***Eulalia chrysaner*, new species**

Eyes of the male (female unknown) distinctly pilose; tomentum of mesonotum wholly black-----

***Eulalia subobscura*, new species**

9. Second antennal segment, from inner aspect, prolonged in a fingerlike process deeply into the flagellum; lower squama transverse, without a projection; origin of vein  $R_{2+3}$  at or slightly before cross vein r-m----- 10

Second antennal segment, from inner aspect, at most gently rounded, not deeply produced into flagellum; lower squama with a prominent, pilose, fingerlike or lobelike process; origin of vein  $R_{2+3}$  far beyond cross vein r-m----- 12

10. Mesonotum and abdomen bluish black; wing as long as entire body.

***Ptecticus salomonensis* Lindner**

Mesonotum and abdomen chiefly brown or yellow; wing about as long as thorax and abdomen combined----- 11

11. Abdomen prominently marked with blackish brown; hind tarsus white on second, third, and base of fourth segments, otherwise black.

***Ptecticus isabelensis* Lindner**

Abdomen, except genitalia, orange in ground color; hind tarsus yellow on second segment, sometimes also on at least parts of first and third, otherwise black or appearing so because of black hair.

***Ptecticus repensans* (Walker)**

12. Ocellar triangle much longer than broad; eyes separated in both sexes, narrowly so in the male, somewhat more broadly so in the female.

***Sargus mactans* Walker**

Ocellar triangle approximately equilateral; eyes of male broadly contiguous, of female widely separated----- 13

13. Larger species, 8 to 9 mm. in length; abdomen in both sexes metallic blue or green; maximum width of anal cell but little greater than that of second basal cell, distinctly less than combined width of two basal cells.

*Cephalochrysa chrysidiformis* (Lindner)

Smaller species, about 4 mm. in length; abdomen of female metallic blue or green, of male in large part yellow; maximum width of anal cell equal to combined width of two basal cells.

*Microchrysa flaviventris* (Wiedemann)

14. Four veins arising from discal cell; that is, media 3-branched----- 15  
Three veins arising from discal cell; that is, media only 2-branched  
(*Pachygasterinae*) ----- 18

15. Terminal segment of flagellum elongated, flattened, vanelike; the preceding two or three segments distinctly furrowed longitudinally on inner surface; abdomen parallel-sided on intermediate segments; scutellum unspined  
(*Hermetiinae*)----- 16

Terminal segment of flagellum elongated but not flattened or vanelike; preceding segments cylindrical; abdomen oval or circular in dorsal outline  
(*Clitellariinae*) ----- 17

16. Eyes bare; mesonotum wholly black; scutellum at most pale-tipped; second abdominal segment with a pair of prominent translucent spots.

*Hermetia illucens* (Linnaeus)

Eyes densely short-pilose; mesonotum with supraalar calli and usually with a spot on each lateral margin, before the suture, green; scutellum with apex broadly green; second abdominal segment without translucent spots.

*Hermetia brunettii* Lindner

17. Body short; abdomen globular; no spines on scutellum or on mesonotum above wing bases; orange-yellow species-----*Ruba tarsalis*, new species  
Body elongated; abdomen ovoid; a pair of apical spines on scutellum and an erect spine on mesonotum above each wing base.

*Negritomyia consobrina* (Bigot)

18. Scutellum prolonged apically into a long digitate process, which is as long as the rest of the scutellum and denticulate laterally.

*Monacanthomyia becki*, new species

Scutellum rounded posteriorly, either unarmed, spined, or denticulate apically, but not as above described----- 19

19. Abdomen short, at least as broad as long, sometimes inflated----- 20  
Abdomen distinctly longer than broad, at most inflated basally----- 26

20. Antennal segments 5 to 7 each with a long slender, pilose process on the inner and a similar one on the outer side; segment four of the female, in addition to the above, with a similar though shorter process on the outer side----- 21

Antennae without prominent lateral processes----- 22

21. Wing without noticeable yellow microtrichia; middle basitarsus usually at most slightly yellow; broad lateral areas of iridescent scales on mesonotum interrupted by broad lateral extensions of the dull-colored median stripe in the male only-----*Ptilocera bergi*, new species

Wings, at least in male, with a cross band of yellow microtrichia running from stigma through discal cell; middle basitarsus distinctly yellow; broad lateral area of iridescent scales on mesonotum interrupted by broad lateral extensions of the dull-colored median stripe in male and female alike-----*Ptilocera bergi flavescens*, new subspecies

22. Second antennal segment prolonged fingerlike along inner margin of flagellum; scutellum rounded posteriorly or hornlike, without spines or denticles----- 23  
 Second antennal segment transverse or at most moderately convex apically, not prolonged along inner margin of flagellum; scutellum with either a few prominent or with numerous minute denticles----- 24
23. Scutellum level with mesonotum, evenly rounded posteriorly; antennae arising from a pair of frontal prominences; style slender, aristalike; stigma much shorter than discal cell; vein  $R_{2+3}$  arising slightly beyond r-m----- *Artemitomima mirabilis*, new species  
 Scutellum hornlike, extending above level of mesonotum; antennae not located on prominences; style as thick as first antennal segment; stigma as long as discal cell; vein  $R_{2+3}$  arising distinctly before r-m.  
*Aulana cyrtaspis* (Kertész)
24. Fifth tergite with a prominent rounded process at its base medially; denticles of scutellar margin all uniformly small and arranged in one row.  
*Adraga australis*, new species  
 Fifth tergite without a definite basal prominence----- 25
25. Scutellum on its posterior margin with several pairs of setiferous cornicles, the apical pair being spinelike; basal complex of flagellum much longer than broad, spindleshaped; body distinctly tomentose, the thorax and abdomen of the male being in large part silvery----- *Wallacea argentea* Doleschall  
 Scutellum on its posterior margin with numerous small denticles arranged in several irregular transverse rows; basal complex of flagellum rounded, slightly higher than long; body bare of conspicuous hairs or tomentum.  
*Pegadomyia nuda*, new species
26. Scutellum with two or four distinct spines----- 27  
 Scutellum unspined, its margin at most with denticles----- 31
27. Arista thickened, straplike; vein  $R_{2+3}$  arising before crossvein r-m and running so close to  $R_1$  that it is not readily apparent; vein  $R_{4+5}$  bent at a sharp angle at juncture with crossvein r-m; vein  $Cu_2+2nd\ A$  fully as long as free section of  $Cu_2$ ----- 28  
 Arista thin; vein  $R_{2+3}$  arising beyond crossvein r-m; vein  $R_5$  not angularly bent at juncture with crossvein r-m; vein  $Cu_2+2nd\ A$  much shorter than free section of  $Cu_2$ ; scutellum 4-spined----- 29
28. Scutellum with 4 spines; mesonotum and scutellum with dense silvery tomentum; wing broadly brownish near costal margin.  
*Acyrocera argyraspis* Lindner  
 Scutellum with 2 spines; mesonotum with yellowish to silvery tomentum, which is not especially dense or conspicuous; wing hyaline.  
*Leveromyia geniculata* Lindner
29. Mesonotum in front of suture with silvery tomentum interrupted by an inverted U-shaped arch of inconspicuous black or brown tomentum----- 30  
 Mesonotum, except narrow lateral margins, mostly with brown tomentum in front of suture----- *Evaza solomonensis solomonensis* Curran
30. All tibiae dark brown----- *Evaza solomonensis incidens* Curran  
 Middle and hind tibiae yellowish white, at most darkened basally and apically----- *Evaza solomonensis whitneyi* Curran
31. Second antennal segment produced thumblike into flagellum on inner side; wings uniformly clouded; mesonotum covered with whitish to pale yellow tomentum, in the female, at least, interrupted by 3 longitudinal vittae of black tomentum; hind femur greatly thickened, with small, blunt spines below----- *Salduba lugubris* Walker

- Second antennal segment distinctly convex, but not produced thumblike into flagellum on inner side; mesonotum without distinct longitudinal vittae of black tomentum; hind femur slender, without spines below----- 32
32. Wings clouded, the clouding more noticeable in a median area running from base to apex, the infuscation becoming lighter toward the costal and posterior margins-----*Lophoteles vittipennis* (Lindner)
- Wings hyaline or uniformly infuscated----- 33
33. All femora conspicuously marked with black.
- Lophoteles dentata*, new species
- All femora yellow-----*Lophoteles plumula* Loew

### Genus CYPHOMYIA Wiedemann

*Cyphomyia* WIEDEMANN, Zool. Mag., vol. 1, pt. 3, p. 55, 1819.

#### CYPHOMYIA MARSHALLI Lindner

*Cyphomyia marshalli* LINDNER, Ann. Mag. Nat. Hist., ser. 10, vol. 20, p. 370, 1937.

Only the female of this species has previously been known. The mesonotum, except the white-haired areas mentioned by Lindner, and the scutellum are covered with a short black tomentum; in the male this black tomentum is much more prominent than in the female and the white median stripe is missing, the white-tomentose areas, therefore, being limited to a small area on each side immediately in front of the suture and to the prescutellar area of the mesonotum. The first and about the anterior half of the second abdominal tergite are dull black.

The type series came from Isabel, Tulagi, and Guadalcanal Islands. Additional records: BOUGAINVILLE ISLAND: 3 females, 1944, and April 10, 1944 (Downs); 1 male, July to September, 1944 (Gurney). GUADALCANAL ISLAND: 5 males, 3 females, August to October 1944 (Berg); 1 male, 2 females, Teneru District, August 6 to October 14, 1944 (Reinschissel and Beck).

### Genus EULALIA Meigen

*Eulalia* MEIGEN, Nouvelle classification, p. 21, 1800.

*Odontomyia* MEIGEN, in Illiger's Magazine, vol. 2, p. 265, 1803.

Of the species referred to *Eulalia* in this work only *E. maculata* (de Meijere) belongs to that genus in a strict sense. New genera will almost certainly have to be proposed for some species, but until the relationships of the Indo-Australian fauna can be better determined such a step seems inadvisable.

#### EULALIA AUREOVESTIS, new species

*Male*.—Head black; vertex and front subshining, face and occiput shining. Erect pile brownish on vertex, black on front between eyes, mostly yellow on face, cheeks, and lower part of occiput; a dense patch of golden tomentum on frontal triangle and similar but more scattered

tomentum on front below ocellar triangle and on the face. Eyes bare, broadly subcontiguous. Face protruding. Oral margin yellow. Antennae slender; ratio of first segment, second segment, flagellum except style, and style 7: 11: 31: 4; style blunt apically; first and second segments and first three segments of flagellum yellow, apical segments black. Proboscis black; palpi slender, yellow.

Ground color of thorax wholly black. Mesonotum and scutellum with abundant scalelike tomentum which might almost be considered pollen; this tomentum golden, except two conspicuous black stripes beginning behind the neck and reaching base of scutellum; pleura with similar tomentum, which becomes whitish and less dense below. Pile of mesonotum and scutellum golden, even on black tomentose areas, rather abundant and about as long as second antennal segment; that of pleura similar but less dense and becoming whitish below. Scutellar spines yellow, half length of scutellum. Middle and hind coxae, last three segments of front and middle tarsi, and last four segments of hind tarsi blackish; legs otherwise yellow. Halteres yellow. Wings subhyaline; stronger veins mostly brown, but those along costal margin yellow before humeral cross vein and beyond discal cell; r-m lacking, the discal cell broadly bordering  $R_s$ ; vein  $R_4$  wanting;  $M_1$  present only at base;  $M_3$  wanting.

Abdomen black with a continuous yellow border on each side which at its broadest is about one-eighth width of abdomen; venter yellow, somewhat discolored from middle of third segment to apex; genitalia yellow. Pile mostly concolorous with background, short and sparse; a few long yellow hairs toward base of second segment. Length, 6.5 mm.

*Holotype*.—Male, Florida Island, March 1945 (G. E. Bohart), U.S.N.M. No. 58469.

**EULALIA AUREOVESTIS SUBAUREA, new subspecies**

*Male*.—This form differs from the typical subspecies in that the black stripes of the mesonotum are much broader, occupying approximately the median half of the mesonotum and separated only by a narrow golden line; the base of the scutellum, except for a spot at the center, is likewise black; the pile of the pleura is uniformly golden; and the yellow margins of the abdomen are broader and less distinctly defined. Length, 7 mm.

*Holotype*.—Male, Guadalcanal Island, April 9, 1945 (Berg). In the author's collection.

*Remarks*.—The characters on which this subspecies is based are all relative, and may be due to individual variation. However, since a study of other members of this family seems to indicate the existence of geographical subspecies in some cases on the various islands or groups of islands it is probable that this subspecies is valid.



**EULALIA MACULATA** (de Meijere)

*Odontomyia maculata* DE MEIJERE, Tijdschr. Ent., vol. 50, p. 229, 1907.

*Eulalia maculata* (de Meijere) LINDNER, Ann. Mag. Nat. Hist., ser. 10, vol. 20, p. 370, 1937.

Recorded from the Solomon Islands without specific locality, by Lindner. Additional records: GUADALCANAL ISLAND: 2 females, July 1944 (Berg); 7 males, August 1944 (Berg); 1 male, 1 female, May 1945 (Berg). BOUGAINVILLE ISLAND: 1 male, August 13, 1944 (Gurney).

**EULALIA BOHARTI**, new species

*Female*.—Head black. Vertex 0.4 width of head; frons parallel-sided, largely rugulose, sparsely clothed with yellowish tomentum, the pair of calli above the antennae shining; face broadening slightly below, shining, with scattered pale yellowish tomentum; facial and occipital orbits with rather dense whitish tomentum; the latter narrow, about as wide as base of first antennal segment. Oral margin reddish yellow anteriorly, brownish posteriorly. Face tuberculate, apex of prominence about equal to apex of first antennal segment. Antenna with first segment, second segment, flagellum without style and style in ratio of 7:9:20:3: style slender, sharp, last two segments of flagellum black, preceding one blackish, the others reddish yellow. Proboscis black, palpi bright yellow. Mesonotum and scutellum bluish black, the surface granular, clothed with moderately dense short yellowish tomentum which becomes whitish laterally; supraalar calli and extreme tip of scutellum, between spines, yellowish; spines one-third length of scutellum; pleura wholly black, with whitish tomentum. All coxae black, front and hind legs otherwise yellow, last three segments of fore and last two of hind tarsi blackish; middle legs probably yellow, segments beyond the trochanters missing in the type. Wings hyaline; veins yellow; becoming brownish at extreme base;  $R_4$  wanting; r-m wanting, the discal cell broadly bordered by  $R_s$ ;  $M_1$  and  $Cu_1$  each plainly evident only at base, continued by a weak fold;  $M_2$  evident more than halfway to wing margin; only a trace of  $M_3$  indicated at base. Squamae blackish. Halteres green. Abdomen entirely greenish yellow; pile concolorous, inconspicuous. Length, 6 mm.

*Holotype*.—Female, Guadalcanal Island, April 7, 1945 (G. E. Bohart), U.S.N.M. No. 58470.

*Remarks*.—This species is closely related to *E. parallelina* (Bezzi), from Fiji, which differs from *boharti* in having the antennae wholly yellow and the front and vertex narrower (vertex 0.32 head width in my specimen; Bezzi describes the vertex as narrower than an eye); the eyes are consequently relatively more conspicuous from the anterior aspect and more tapering outwardly. *E. exigua* Lindner, from



Amboina, seems to belong to this group, but according to the description differs in the shining front with definitely arranged tomentose spots, the wholly reddish brown antennae, and the broad pale apex of the scutellum.

*EULALIA CHRYSANER*, new species

*Male*.—A rather slender species. Face and frontal triangle taken together forming an almost equilateral triangle, the base of which is about one-third head width; face from side view rather strongly but evenly convex. Head black, oral margin slightly brownish; some blackish pile on part of frontal triangle that extends narrowly between the eyes, on occiput, and on cheeks; a small patch of silvery tomentum on frontal triangle and two similar patches on each ocular orbit, one of these being opposite oral margin and one at about middle of face; face shining, with a few scattered black hairs. Eyes bare, broadly contiguous. Antenna slender, one-and-one-third times length of head; ratio of first segment, second segment, flagellum excluding style, and style, 20:25:45:5; first and second segments each three times as long as maximum width; style short, cylindrical, blunt; first and second segments yellow with black hairs; flagellum black with yellowish pollen. Proboscis black; palpi small, clavate, yellow with black hair.

Ground color of thorax, including scutellum, entirely black with a slightly bluish cast. Mesonotum and scutellum covered with dense yellow tomentum interrupted by areas of black tomentum, which takes the form of a median stripe, a lateral one on each side, and a rounded spot, immediately in front of the suture, on each side of the lateral stripe and narrowly connected with it along the suture; median stripe straight, the lateral ones curved strongly outward anteriorly; the three stripes ending slightly short of anterior margin of mesonotum and extending about halfway from suture to scutellum. Mesonotum and scutellum with scattered though plainly evident black hairs; pleura with a few yellowish hairs above and abundant silvery tomentum. Scutellum with two small yellow spines.

Coxae black; femora black, their apices yellow, broadly so on front pair, narrowly so on middle and hind pairs, tibiae yellow; tarsi yellow, the last two or three segments brownish; pile of femora largely black, that of legs otherwise mainly yellow. Wings milky; veins brownish, becoming suddenly yellow beyond discal cell; vein r-m absent, the radial sector forming the upper margin of the discal cell; veins  $R_4$  and  $M_3$  absent; vein  $M_1$  distinct at base, thence continued for a short distance as a fold. Halteres yellow.

Abdomen mainly reddish yellow; first sternite, sides of first tergite, and basal angles of second tergite, blackish; fourth and fifth tergites and sides of fourth and fifth sternites black, from certain angles appearing as distinctly steel-blue. Pile and tomentum of abdomen black. Length, 7 mm.

*Female*.—Relative measurements of head from front view: Width of vertex, 28; width of front at base of antennae, 30; width of face at oral margin, 35; maximum width of head, 75. Frontal calli prominent; vertex, frontal calli, and face shining; silvery-tomentose areas of face as in male but much more prominent; a similar area on ocular orbit below frontal callus and a transverse band between frontal callus and vertex. Third antennal segment proportionately a little longer than in the male. Pattern of mesonotum essentially as in male except that the black areas, especially of the presutural lateral spots, are larger; the bright tomentum, however, is grayish yellow rather than golden and is not so long or dense as in the male. No erect pile on mesonotum or upper parts of pleura. Abdomen wholly black, posterior margins of first, second, and third sternites, however, very narrowly reddish; tergites with a distinct steel-blue cast; sternites bluish in certain lights. Length, 8 mm.

*Holotype*.—Male, Bougainville Island, 1944 (Downs), U.S.N.M. No. 57306.

*Allotype*.—Female, same data.

*Paratype*.—Female, Bougainville Island (Downs) [American Museum of Natural History].

*Remarks*.—This species traces, rather imperfectly because of the coloration of the legs and abdomen, to *Odontomyia finalis* (Walker) in Brunetti's key. Though both Walker's description and Brunetti's redescription fail to mention certain important characters, *finalis* is probably a closely related species.

#### EULALIA SUBOESCURA new species

*Male*.—General coloration deep black. Eyes briefly contiguous above frontal triangle; lower facets smaller than those of upper areas, but areas not sharply defined; eyes clothed with dense, moderately long, black pile, which is denser and longer above than below. Face prominent, rounded and protruding in lateral profile, rounded in transverse section. Head entirely shining. Pile black, except for that on inner part of cheeks, next to oral margin, and on adjacent area of occiput, which is long, silky, and yellowish; a dense tuft of pile at upper angle of frontal triangle and another just below ocellar triangle, the intervening areas bare; pile otherwise regularly distributed on face, vertical triangle, and occiput. Antenna equal to length of head, yellow on first two segments and base of flagellum, blackish from middle of first segment of flagellum, and becoming black toward style; ratio of first segment, second segment, flagellum excluding style; and style, 9:10:23:2; flagellum with six segments, the penultimate one very short, the ultimate one forming the distinct, cylindrical, blunt style. First two antennal segments black-pilose. Proboscis black; labella rigid, three-fourths as long as head, rather

broad, maximum width one-third the length; palpi slender, yellow, black-haired.

Thorax mostly subshining; spines of scutellum subequal to scutellum in length, yellow; narrow extreme apex of scutellum sometimes yellowish. Pile of thorax entirely black, except, in some specimens, a tuft above each front coxa; that of mesonotum and scutellum long, erect; that of pleural and sternal areas erect to subapressed and not so long or dense. Femora black except apices; tibiae yellow to yellowish brown; tarsi bright yellow at base, last three segments of front and last two of intermediate and hind pairs brownish to black, the individual segments each becoming darker toward their apices. Wing yellowish hyaline, somewhat brownish subhyaline in the area of the stronger veins; veins yellow, becoming brownish on posterior half;  $R_4$  wanting; m-cu wanting, the radial sector forming broad upper part of discal cell;  $M_1$  represented by a spur and a fold;  $M_2$  distinct almost to the wing margin;  $M_3$  wanting. Halteres yellow.

Abdomen broader than thorax; coloration variable; tergites subopaque, becoming shining, with a bluish black reflection, apically entirely black, or with a large, subquadrate, subobscure brownish spot near each lateral margin of segments two, three, and sometimes four; venter wholly black to largely brownish. Genitalia small, black. Length, 7.5 to 8 mm.

*Holotype*.—Male, Bougainville Island, 1944 (Downs), U.S.N.M. No. 57307.

*Paratypes*.—4 males, Bougainville Island, April 10, 1944 (Downs), July 13, 1944 (Gurney), and no date, 1944 (Gurney); 2 males, Empress Augusta Bay, Bougainville Island, March 1944 (Downs); 2 males, Bougainville Island (Downs).

*Remarks*.—In Brunetti's key this species traces to *atraria* Walker, which, according to Brunetti's redescription, has bare eyes and a weakly developed vein  $M_2$ . *Stratiomys nexura* Walker, the type of Bigot's genus *Euceromys*, appears from the descriptions to be a similar species but the proportions of the antennal segments are different (first segment, second segment, and flagellum in the ratio 1:1:4) and, according to information furnished me by James E. Collin, cross-vein r-m is present.

#### Genus PTECTICUS Loew

*Ptecticus* LOEW, Verh. Zool. Bot. Ges. Wien, vol. 5, p. 142, 1855.

#### PTECTICUS SALOMONENSIS Lindner

*Ptecticus longipennis salomonensis* LINDNER, Ann. Mag. Nat. Hist., ser. 10, vol. 20, pp. 372-373, 1937; not *Ptecticus salomonensis* Lindner, Ann. Mag. Nat. Hist., ser. 10, vol. 20, p. 393, 1937.

I believe this form is more than a subspecies of *Ptecticus longipennis* (Wiedemann). The male genitalia are entirely different; the

wings are a little shorter than in *longipennis* and lack the clouding at the apex; the abdomen, as Lindner pointed out, is entirely bluish black dorsally, or almost so.

The type series came from Isabel Island. Additional records: GUADALCANAL ISLAND: 2 males, 1 female, December 1944, to March 1945 (Berg); 1 male, April to May 1945 (Berg); 2 females, Lunga River Valley, October 17 and 27, 1944 (Laffoon); 1 female, Malimbu River Valley, November 12, 1944 (Laffoon); 1 female, 1 male, Uma-sami River Valley, October 2, 1944 (Laffoon). FLORIDA ISLAND: 3 males, 1 female, March 1945 (Bohart). NEW GEORGIA ISLAND: 1 female, 1943 (Downs).

**PTECTICUS ISABELENSIS Lindner**

*Ptecticus isabelensis* LINDNER, Ann. Mag. Nat. Hist., ser. 10, vol. 20, p. 373, 1937.  
*Ptecticus salomonensis* LINDNER, Ann. Mag. Nat. Hist., ser. 10, vol. 20, p. 393, 1937. ("Nachtrag" of above citation).

Lindner's published account of *P. salomonensis* seems puzzling. His description, as well as the statement that he is describing the previously undescribed male, preclude the possibility that he is referring to *longipennis salomonensis*; moreover, *P. salomonensis*, as well as *P. longipennis salomonensis*, is included in the list of new species described from the Solomon Islands (pp. 370–371), whereas *P. isabelensis*, the only other *Ptecticus* from the Solomon Islands treated in that work, is missing. This confused state of affairs is clarified in a separate sent to me personally, in which Lindner marked out *salomonensis* in the list and in the Nachtrag and wrote *isabelensis* instead.

Known only from Isabel Island, the type locality.

**PTECTICUS REPENSANS (Walker)**

*Sargus repensans* WALKER, Proc. Linn. Soc. London, vol. 4, p. 96, 1860.

*Ptecticus repensans* (Walker) BRUNETTI, Rec. Indian Mus., vol. 1, p. 112, 1907.

The Solomon Islands form apparently represents a variety that differs from the typical form of this species in the coloration of the hind tarsus. The first and second segments are yellow, with black hair on the basal third of the first and at the apex of the second segment, the remaining hair being yellow; the last three segments are mainly black or blackish with black hair. The last three segments of the front and middle tarsi are black. The body is orange-yellow; the abdominal segments have each a prominent patch of short black hair; the male genitalia are large and black. Length, 12–14 mm.

Collecting records. GUADALCANAL ISLAND: 1 female, November 11, 1944 (Berg); 1 male, December 1944 (Berg); 1 male, Mount Austin, 1,000 ft., November 14, 1944 (Laffoon); 1 female, Lunga River Valley,

September 16, 1944 (Laffoon). FLORIDA ISLAND: 1 female, 3 males, March 1945 (Bohart).

Genus *SARGUS* Fabricius

*Sargus* FABRICIUS, *Entomologia systematica*, Suppl., pp. 549, 566, 1798.

*SARGUS MACTANS* Walker

(?) *Sargus metallinus* FABRICIUS, *Systema antliatorum*, p. 258, 1805.

*Sargus mactans* WALKER, *Proc. Linn. Soc. London*, vol. 4, p. 97, 1860.

*Sargus redhibens* WALKER, *Proc. Linn. Soc. London*, vol. 4, p. 97, 1860.

Lindner has synonymized *redhibens* with *mactans*; these two forms may be mere color varieties of *metallinus*, although they may be valid geographical subspecies. In *redhibens* the femora are marked with black and the hind tibia, at least, is brown on its basal third; in *mactans* the femora are wholly yellow and the hind tibia brownish on the basal third; in *metallinus* all femora and tibiae are yellow. The United States National Museum has about 80 specimens. The series from the Solomon Islands is, as Lindner found in the material he examined, with males of *mactans* and females of *redhibens*; in other series from Singapore, India, and the Philippine Islands the forms *mactans* and *redhibens* are represented in both sexes. I can find no structural differences.

This species has been recorded by Lindner from Guadalcanal, Russell, Kolombangara, and Tulagi Islands, and by Curran from Guadalcanal and Choiseul Islands.

Additional records: GUADALCANAL ISLAND: 4 males, 5 females, August to December 1944 (Berg); 1 female, Cape Esperance, October 15, 1944 (Laffoon); 8 males, 2 females, Lunga River Valley, September 6 to October 17, 1944 (Laffoon). BOUGAINVILLE ISLAND: 1 female, April 10, 1944, and 1 male (Downs). NEW GEORGIA ISLAND: 1 female, Munda Point, 1943 (Downs).

Genus *CEPHALOCHRYSA* Kertész

*Cephalochrysa* KERTÉSZ, *Trans. Linn. Soc. London*, vol. 15, p. 99, 1912.

*CEPHALOCHRYSA CHRYSIDIFORMIS* (Lindner), new combination

*Microchrysa chrysidiformis* LINDNER, *Ann. Mag. Nat. Hist.*, ser. 10, vol. 20, pp. 373-374, 1937.

The types came from San Cristobal Island. Additional records: BOUGAINVILLE ISLAND: 1 female, 1944 (Downs); 1 female, Empress Augusta Bay, March 1944 (Downs). NEW GEORGIA ISLAND: 2 females, Munda Point, 1943 (Downs).

## Genus MICROCHRYSA Loew

*Microchrysa* LOEW, Verh. Zool. Bot. Ges. Wien, vol. 5, p. 146, 1855.

## MICROCHRYSA FLAVIVENTRIS (Wiedemann)

*Sargus flaviventris* WIEDEMANN, Analecta Ent., p. 31, 1824.

*Microchrysa flaviventris* (Wiedemann) OSTEN SACKEN, Ann. Mus. Genova, vol. 16, p. 417, 1881.

This common species is widely distributed throughout a large part of the oriental region and the East Indies. Lindner has recorded it from Russell Island. GUADALCANAL ISLAND: 2 males, 2 females, August to December 1944 at a garbage dump; 1 female, Poha River, September 10, 1944 (Laffoon). BOUGAINVILLE ISLAND: 2 males 1944 and April 10, 1944 (Downs). FLORIDA ISLAND: 1 male, 1 female, March 1945 (Bohart).

## Genus HERMETIA Latreille

*Hermetia* LATREILLE, Histoire naturelle des crustacés et des insectes, vol. 14, p. 338, 1804.

## HERMETIA ILLUCENS (Linnaeus)

*Musca illucens* LINNAEUS, Systema naturae, ed. 10, vol. 1, p. 589, 1758.

*Hermetia illucens* (Linnaeus) LATREILLE, Histoire naturelle des crustacés et des insectes, vol. 14, p. 338, 1804.

This common American species has become quite widely distributed throughout the warmer parts of the Old World, but has not been recorded in literature from the Solomon Islands, where, however, it appears to be quite common. Additional records: GUADALCANAL ISLAND: 14 males, 14 females, September 1944 to April 19, 1945 from latrines, hog wallows, coconuts, and rotten papayas (Berg); 2 males, 7 females, Tengeru District, August 6 to November 1, 1944 (Reinschissel, Beck); 6 males, 4 females, Lunga River Valley, October 3-13, 1944 (Laffoon) and December 28, 1943 (Knight). BOUGAINVILLE ISLAND: 1 female, Empress Augusta Bay, April 1944 (Downs); 1 male, 1944, and 2 females (Downs).

## HERMETIA BRUNETTII Lindner

*Hermetia burnettii* LINDNER, Ann. Mag. Nat. Hist., ser. 10, vol. 20, pp. 381-382, 1937.

The type series came from Tulagi, Bougainville, and Shortland Islands.

Additional records: GUADALCANAL ISLAND: 3 females, November-December 1943 (Gurney); 9 females, September 1944 to June 1945 (Berg). BOUGAINVILLE ISLAND: 4 males, 3 females, 1944 (Downs). TREASURY ISLAND: 1 male, July 21, 1944 (J. H. Paullus). NEW GEORGIA ISLAND: 1 male, 1 female, Munda Point, 1943 (Downs). FLORIDA ISLAND: 3 females, March 1945 (Bohart). Two females from Guadalcanal (Berg) and the one from New Georgia lack the



presutural green spots, but otherwise they agree with the more typical specimens.

Genus RUBA Walker

*Ruba* WALKER, Proc. Linn. Soc. London, vol. 4, p. 100, 1860.

RUBA TARSA LIS, new species

An orange-yellow species with darkened tarsi, otherwise orange-yellow legs, and infumated wings. This color combination will readily separate this species from any of the four previously described.

*Male*.—Eyes broadly contiguous, clothed with short, scattered hairs; no well-defined zone of smaller facets. Ocellar triangle black; head otherwise yellow, with yellow pile. Ratio of antennal segments 12:13:15:9:9:4:6:5:7:35; first and second segments yellow, third to seventh inclusively brownish, eighth to tenth black; antennal pile black. Proboscis yellow; terminal palpal segment rounded, black. Thorax yellow, with pile mostly yellow; a longitudinal patch on middle of mesonotum, however, extending from suture to anterior margin, blackish. Legs mainly yellow; tarsi brownish, becoming mainly blackish beyond basitarsi; pile of apical half of tibiae and of tarsi black, that of tarsi quite dense. Wings infumated, with brown veins, the veins and membrane both becoming paler toward base. Abdomen yellow with short, yellow pile. Length, 8 mm.

*Female*.—Width of head, in micrometer units, 75; of vertex, 30; of front at narrowest point (just above base of antennae) 20; of face at oral margin, 27. Front shining. Pile of mesonotum wholly pale. Otherwise as in male. Length, 9 mm.

*Types*.—Holotype, male, Guadalcanal Island, February–March 1945 (Berg); U.S.N.M. No. 57308.

*Allotype*.—Female, same data.

*Paratypes*.—1 male, 1 female, same data; 1 female, Bougainville Island, 1944 (Downs); 1 female, Guadalcanal Island, 1944 (Rein-schissel); 7 females and 5 males, Guadalcanal, from larvae collected April 11 and 19, 1945 (Berg).

Genus NEGRITOMYIA Bigot

*Negritomyia* BIGOT, Bull. Soc. Ent. France, ser. 5, vol. 7, p. lxxiv, 1877.

NEGRITOMYIA CONSOBRINA (Bigot)

*Ephippium consobrina* BIGOT, Ann Soc. Ent. France, ser. 5, vol. 9, p. 208, 1879.

*Negritomyia consobrina* (Bigot) VAN DER WULP, Catalogue of the Diptera of South Asia, p. 53, 1896.

This species was recorded by Lindner from Florida, Guadalcanal, and Vella Lavella Islands.



Additional records: GUADALCANAL ISLAND: 32 males, 22 females, July to December 1944, and May to July 1945 (Berg); 6 females, 5 males, Teneru and Nalimbu Districts, August 6 to November 1, 1944 (Beck); 1 male, November to December 1943 (Gurney); 6 females, 12 males, Lunga River Valley, September 8 to November 11, 1944 (Laffoon); 1 male, Cape Esperance, October 15, 1944 (Laffoon). BOUGAINVILLE ISLAND: 4 males, 1944 and April 10, 1944 (Downs); 1 female, 1944 (Gurney); 1 female, Empress Augusta Bay, March 1944 (Downs). NEW GEORGIA ISLAND: 1 male, April 1944 (Berg); 1 female, Munda Point, 1943 (Downs). FLORIDA ISLAND: 1 male, March 1945 (Bohart); 1 male, 1 female, Tulagi (W. M. Mann). SAN CRISTOBAL ISLAND: 1 female, Pamua (Mann).

I believe that eventually *consobrina* (Bigot) and *maculipennis* (Macquart) will be proven synonymous, the latter name holding priority. The main characters for distinguishing the two are the color of the femora and the extent of the infuscated area at the wing apex; in *maculipennis* all femora are broadly yellow basally and the infuscation of the wing extends to the apex, whereas in *consobrina* all femora are entirely black, and the extreme apex of the wing becomes subhyaline. The Solomon Islands specimens have at most a trace of yellow at the bases of the femora, usually the femora are wholly black. In the Guadalcanal specimens the wing apex is always subhyaline; in the others it is variable, but more commonly the entire apical area is infuscated. If two geographical subspecies are present, intergradation occurs over a very wide area, extending from the Solomons through New Guinea to the Philippine Islands. The type locality of *consobrina* is "New Guinea"; that of *maculipennis* is Manila, P. I.

#### Genus MONACANTHOMYIA Brunetti

*Monacanthomyia* BRUNETTI, Rec. Indian Mus., vol. 7, p. 448, 1912.

#### MONACANTHOMYIA BECKI, new species

*Male*.—Head black; occiput shining above, bare, subshining below, with sparse yellowish tomentum; vertical triangle small, subshining; face and frontal triangle densely white-tomentose. Eyes broadly contiguous, upper facets much larger than lower ones, but line of separation not distinct. Antenna inserted on lower part of head, short; first segment subconical; second expanded and rounded apically; third reniform, its convex face in contact with second segment, distinctly higher than long; arista short-pubescent, twice length of rest of antenna combined; antenna yellow, arista, except extreme base, black. Proboscis and palpi yellow.

Thorax reddish yellow; a middorsal stripe of varying extent but apparently, when well developed, extending from anterior margin of

mesonotum to apex of scutellar process, brownish to blackish; this stripe evident on prescutum (where the pattern varies), just before scutellum, and on scutellum, at least on its apical process; scutellum sometimes blackish laterally. Thorax slightly though noticeably swollen in supraalar region and subalar regions of mesopleura, sternopleura, and pteropleura. Scutellar process equal in length to basal part of scutellum; sides of scutellum, including process, with numerous small setiferous denticles.

Legs slender; tarsi flattened; each basitarsus longer than remaining segments combined. Fore tarsus and hind tibia blackish; fore tibia brownish; hind tarsus yellow to brownish; legs otherwise reddish yellow. Wing chiefly hyaline, the stigma, the apex involving chiefly cell  $R_4$ , and the narrow costal margin between these areas infuscated; vein  $R_{2+3}$  arising slightly before to slightly beyond cross-vein  $r-m$ . Halteres yellow.

Abdomen ovate, length about 1.25 maximum width; reddish yellow. Genitalia small, reddish yellow. Length, 3.5 to 5 mm.

*Holotype*.—Male, Teneru District, Guadalcanal Island, October 14, 1944 (Beck), U.S.N.M. No. 58471.

*Paratype*.—Male, Umasami River Valley, Guadalcanal Island, October 2, 1944 (Laffoon).

*Remarks*.—*Monacanthomyia annandalei* Brunetti, the genotype, is the only previously described species positively referred to this genus. According to Brunetti and Kertész, *Prostomomyia atronitens* Kertész and *Ceratothyrea nigrifemur* de Meijere probably also belong here. The yellow body and the coloration of the legs will readily distinguish *becki* from these three species.

#### Genus PTILOCERA Wiedemann

*Ptilocera* WIEDEMANN, Nova dipterorum genera, p. 7, 1820.

An interesting integumentary character of this genus is the possession of dense, microscopic, setigerous plates, each isolated from the others and, as a rule, round in outline. The setulae borne by these plates may be simple inconspicuous hairs; they may be somewhat flattened, appressed, and as a rule whitish, thus forming, in their aggregations, tomentose patches; or they may be still further flattened and broadened, in the form of iridescent scales. The integument has been erroneously described as punctured. True setigerous punctures do, however, occur on the head.

#### PTILCOCERA BERGI, new species

*Female*.—Head black. Front at narrowest point about 0.22 head width; its upper half, including vertex and ocellar triangle, with numerous piliferous punctures of irregular density and interrupted

by a small glabrous triangle on each ocular margin opposite anterior ocellus; lower half of front bare and glabrous except for a small patch of silvery tomentum adjacent to each eye. Facial and occipital orbits silvery tomentose; face, except shining median tubercle, with erect whitish pile; pile of occiput more yellowish and less erect. Antennae mainly black and black-pilose; first two segments of flagellum, taken together, about as long as broad; terminal segment of flagellum about four times as long as subterminal one, white and white-haired on its apical half or more.

Thorax black in ground color, the setigerous plates appearing greenish in certain lights; a broad median vitta, extending almost to base of scutellum, with extremely short black hair; broad sides of mesonotum, scutellum, and upper parts of the pleura with emerald-green iridescent scales which appear violet in certain lights; from certain angles these scales seem to cover only certain definite areas, but with a change of light incidence they are seen to cover the entire region as described; pleura below with yellowish to whitish hair. Scutellum two-thirds as long as broad; median spines about one-third as long as scutellum; spines wholly black to broadly yellow tipped. Legs black, the tarsi, especially intermediate ones, tending to become yellowish; pile of legs yellowish to brownish yellow, that of tarsi becoming golden to reddish yellow. Wings blackish, the intensity of the infumation decreasing toward alula, which is subhyaline.

Abdomen black in ground color; the setigerous plates, however, shining green and giving the abdomen a subshining green appearance when viewed by the naked eye; a small patch of silvery tomentum on each side of the third segment near its anterior margin and at some distance from its lateral margin; setulae of tergites otherwise black, visible only under high magnification except on the first and anterior part of the second segment; some inconspicuous pale pile ventrally. Length, 8 to 11 mm.

*Male*.—Eyes contiguous; patch of silvery tomentum on front and a dense patch of short erect black hair between eyes in front of the ocellar triangle. Antennae entirely black. Pile of median stripe of mesonotum sometimes with a reddish cast; the stripe more extensive than in the female, extending onto the scutellum, and crossed behind the suture by a transverse stripe of approximately equal width, thus leaving on the mesonotum a cross-shaped area which is devoid of iridescent scales. Median scutellar spines nearly half as long as scutellum, broadly yellowish at apices. Differs otherwise only sexually. Length, 7 to 10 mm.

*Holotype*.—Female, Guadalacanal Island, July 1944, July 1945 (Berg), U.S.N.M. No. 57309.

*Allotype*.—Male, same data.

*Paratypes*.—107 females, 109 males, same data; 5 females, 8 males, Lunga River Valley, Guadalcanal Island, September 9 to October 17, 1944 (Laffoon); 2 females, 1 male, Malimbu River Valley, Guadalcanal Island, November 12, 1944 (Laffoon); 6 females, 3 males, Teneru District, Guadalcanal Island, August 6, October 30, November 1, and December 10, 1944, and April 14, 1945 (Beck); 4 females, Guadalcanal Island (Beck); 1 female, Guadalcanal Island, July 23, 1945 (Frank Cilley).

Two males, one from "S. W. Pacific 85, Area 1," June 17, 1944 (Beck) and one from "Solomon Islands," July to August, 1909 (W. W. Froggatt), are this species, but are not included in the type series.

*Remarks*.—This species, a *Ptilocera* in the strict sense, may readily be distinguished from all previously described species of the genus by the absence of whitish tomentum on the fourth and fifth abdominal segments.

The Guadalcanal material seems quite uniform, except for size and minor color variations. However, specimens of *bergi* from the other islands of the Solomons group are more variable. Two females from Florida Island, March 1945 (Bohart) are like the Guadalcanal females except that the middle basitarsus is wholly yellow. A female from Santa Cruz Island (W. M. Mann) has the terminal antennal segment wholly whitish and white-haired; the legs are yellowish to brownish, but this may be due to the aging condition of the specimen. It is quite probable that when the fauna of the islands is better known several distinct subspecies may be recognized. Specimens from Bougainville Island are sufficiently distinct and numerous enough in the collection to warrant description as a subspecies; I am calling this:

**PTILOCERA BERGI FLAVESCENS, new subspecies**

Differs from the typical form as follows. The wing is partially transversed by a band of yellow microtrichia extending from the stigmal area through the apical half of the discal to the basal portion of the third and fourth posterior cells; this band is prominent in the male but only weakly developed in the female. The middle basitarsus is distinctly yellow. The scutellar spines are yellowish apically in both sexes. In the female, the broad lateral areas of iridescent scales on the mesonotum are interrupted by a longitudinal band of hairs to each side of the median band; all these hairs have a reddish cast. Length, 9 to 10 mm.

*Holotype*.—Female, Bougainville Island, April 10, 1944 (Downs), U.S.N.M. No. 57310.

*Allotype*.—Male, same data.

*Paratypes*.—3 males, same data; 1 male, Bougainville Island, 1944 (Downs); 1 male, Bougainville Island, July 1 to September 15, 1944

(Gurney); 1 female, Bougainville Island, 1944 (Gurney); 1 female, Empress Augusta Bay, Bougainville Island, February 1944 (L. J. Bennett); 1 male, Empress Augusta Bay, March, 1944 (Downs); 2 males, Bougainville Island (Downs).

**ARTEMITOMIMA, new genus**

*Female* (male unknown).—Head, excluding prominences at antennal bases, distinctly higher than long and a little broader than high; occiput concave from dorsal view, transverse below; ocellar triangle a little longer than wide, removed from occiput by a little more than its length; vertex and upper part of front narrow, parallel-sided, about 0.15 head width, then abruptly widening above antennae to width of face, which is parallel-sided and about 0.25 head width; front with a low but sharp carina beginning on each side of anterior ocellus and extending along ocular orbit to point where front begins to widen, the two carinae distinctly though narrowly separated from each other for their entire length; each frontal callus produced into a prominence which takes the form of a truncated half-cone, as high as length of first antennal segment, from the lower inner surface of which the antenna arises. Facial orbits moderately broad above but evanescent below; occipital orbits narrow, evanescent along upper posterior margin of each eye; lower posterior margin of eye concave in lateral profile; eyes bare. Proboscis short; labella large, extending when withdrawn to within length of first antennal segment from base of antenna; no distinct oral margin. Antenna porrect; first segment twice as long as wide; second from outer view about as long as wide, from inner twice as long as a result of its prolongation along side of flagellum; second segment and flagellum together forming a lanceolate complex terminating in a long slender aristalike style; flagellum composed of three major segments, strikingly oblique in outline, followed by two moderately short ones and a 3-segmented style, the basal two segments of which are short, the apical one as long as the remaining antennal segments combined.

Thorax long, its length, including scutellum, about twice maximum width, its width at wing bases about 1.6 that across humeri; propleura well developed; scutellum about as long as broad, rounded and distinctly margined behind, without spines or denticles. Legs long, slender; basitarsus of each leg longer than following tarsal segments combined; last three segments of each tarsus each no longer than broad. Wing slender, almost four times as long as wide; discal cell roughly diamond-shaped with basal and apical angles truncated, unusually large, its transverse diagonal about half wing width; stigma short, sclerotized; stem of  $R_2$  and vein  $R_{2+3}$  each short and forming part of stigma; r-m present;  $R_{2+3}$  arising slightly behind r-m;  $R_4$  erect short.



Abdomen roughly diamond-shaped, as broad as long, broader than maximum width of thorax, broadest at base of third segment, moderately thick and rather strongly arched behind in lateral profile.

*Genotype*—*Artemitomima mirabilis*, new species.

The relationships of this interesting genus are rather difficult to determine. In Kertész's<sup>3</sup> key to the genera of Pachygasterinae it runs best to *Ageiton*, paragraph 128, but, among other things, the antennal structure and wing venation are of an entirely different type. Perhaps the closest relationship is with *Salduba*, which has a similar though by no means identical antennal structure and which shows a number of other characters in common with *Artemitomima*; however, *Salduba* may readily be distinguished by the lack of frontal prominences, by the long, parallel-sided abdomen, and by the thickened, denticulated hind femur. The resemblance of *Artemitomima* to the genera of the *Artemita* complex, though striking, is purely superficial.

ARTEMITOMIMA MIRABILIS, new species

*Female*.—Lower frontal and upper facial orbits reddish yellow; head otherwise black; vertex and uppermost part of occiput rugulose; rest of upper half of occiput, upper half of front, and frontal prominences shining, bare; lower half of occiput with whitish pile; a transverse area just above frontal prominences, lower frontal orbits, facial orbits, and occipital orbits whitish tomentose. First antennal segment shining black, with black hair; second segment yellow, with black hair; flagellum yellow on ventral half of first three segments, otherwise blackish; long terminal segment of style, except extreme base, white; flagellum and style with short white to whitish pubescence. Labella brownish, yellow at base.

Thorax entirely black, mostly rugulose because of the tomentum-bearing punctures, but with several areas on the pleura and sterna bare and polished; the most noticeable of these is an area below each wing base, on the pteropleuron, the anterior part of which area is longitudinally striated. Tomentum of thorax basically black, with the following areas yellowish; and inverted Y-shaped area on the mesonotum, its stem running from anterior margin of mesonotum to suture, one arm extending to each side of scutellum; the scutellum, except its broad lateral slopes; the propleura; a band covering the front coxa and extending along anterior margin of mesopleuron onto mesonotum; a band extending from lower part of sternopleuron, near intermediate coxa, across posterior part of mesopleuron and onto mesonotum immediately in front of suture; and a band taking in metapleuron and supraalar callus and areas immediately surrounding it. Legs black;

<sup>3</sup> Ann. Mus. Nat. Hungarici, vol. 14, pp. 127-140, 1916.

first and second segments of intermediate tarsus and most of hind basitarsus yellow. Halteres whitish. Wing brownish beyond discal cell, on narrow posterior border, and on a narrow band that almost crosses wing through apical part of basal cells and along veins  $Cu_2$  and  $Cu_2 + 2nd\ A$ ; membrane otherwise mainly hyaline; veins brownish, yellow at extreme base and at weakened part of costa and radius immediately before stigma; stigma brown.

Abdomen black; anterior margin of first tergite, a rounded spot on each side of third confluent with margin, an oblique band on each side of fourth, lateral margins of all tergites, entire fifth tergite, and venter yellow tomentose, abdomen otherwise black tomentose. Genitalia yellow. Length, 8 mm.

*Holotype*.—Female, Guadalcanal Island, 1944 (Berg). U.S.N.M. No. 57311.

*Remarks*.—Mr. Berg adds this note: "I took it Nov. 11, 1944, resting on underbrush about 3 feet from the ground. I was collecting well back into the foothills of the Kavo Range, on Mount Austin at an elevation of about 800 feet. Though I collected there on two more occasions, I never saw it again."

#### Genus AULANA Walker

*Aulana* WALKER, Proc. Linn. Soc. London, vol. 7, p. 204, 1864

##### AULANA CYRTASPIIS (Kertész)

*Acraspidea cyrtaspis* KERTÉSZ, Ann. Mus. Nat. Hungarici, vol. 6, p. 344, 1908.

*Aulana cyrtaspis* (Kertész) BRUNETTI, Rec. Indian Mus., vol. 25, p. 60, 1923.

This species was recorded by Lindner, without locality, from the Solomon Islands. Additional records: BOUGAINVILLE ISLAND: 1 female, 1944 (Downs). GUADALCANAL ISLANDS: 7 females, January 6, 1945 (Berg). FLORIDA ISLAND: 2 females, Moro, 1945 (Bohart). The Florida Island specimens differ from the others in having predominantly black femora.

#### Genus ADRAGA Walker

*Adraga* WALKER, Proc. Linn. Soc. London, vol. 3, p. 82, 1859.

This genus is closely related to *Pegadomyia*. Two species have been previously described: The genotype, *A. univitta* Walker, from the Aru Islands, and subsequently redescribed by Kertész and Brunetti from Mysol, and *A. crassivena* Kertész, from Batjan. The following key will serve to separate these two species and the one described below.

1. Pile of mesonotum short and inconspicuous, uniformly black----- 2  
     Mesonotum with a median stripe of yellowish pile-----*univitta* Walker
2. Abdominal tergites one to four wholly punctured-----*crassivena* Kertész  
     Abdominal tergites one to four densely punctured on the disc, shining  
     laterally-----*australis*, new species



## ADRAGA AUSTRALIS, new species

*Male*.—Head, thorax, and abdomen black. Vertical triangle and upper angle of frontal triangle shining; most of front, face, genae, and lower postocular orbits densely whitish tomentose. Third antennal segment much higher than long; first and second segments whitish; third reddish brown outwardly, blackish apically and on inner aspect; arista blackish. Proboscis blackish. Mesonotum and scutellum with numerous punctures, each giving rise to a minute black hair; pleura largely polished and bare, but mesopleura with whitish pile, lower parts of mesopleura and of pteropleura with scattered, short black pile, and metapleura yellow-tomentose. Scutellum distinctly margined; apex and sides with about 30 dentulae. Legs largely black; hind tarsus and extreme apex of front femur yellow; front basitarsus moderately thickened and longer than remaining four segments combined. Wing subhyaline; apical half of costal cell and an oval area occupying apical half of anal cell, basal portion of the fifth posterior cell, extreme base of discal cell, and adjacent area of second basal cell, for about half its width and half its length, somewhat darker, the limits of the darkened areas poorly defined; stigma yellow; veins on basal half to middle of discal cell blackish, those on apical half yellow. Halteres yellow, the knob becoming blackish. Abdomen with numerous black-setulose punctures which become less numerous laterally and on fifth segment; the disc with dense black pollen, the broad lateral margins, except on segment 1, and the fifth segment shining; venter dulled with grayish pollen on segment one, otherwise shining, but with scattered black-setulose punctures. Genitalia small, yellow. Length 3.5 mm.

*Holotype*.—Male, lumbered area  $2\frac{1}{2}$  miles from mouth of Tenaru River, Guadalcanal Island, April 8, 1945 (Berg), U.S.N.M. No. 58472.

*Remarks*.—This species is evidently very close to *A. crassivena* Kertész, but it differs from the description in a number of details, the most important of which is indicated in the key.

## Genus WALLACEA Doleschall

*Wallacea* DOLESCHALL, Nat. Tijdschr. Ned. Ind., vol. 17, p. 82, 1858.

## WALLACEA ARGENTEA Doleschall

*Wallacea argentea* DOLESCHALL, Nat. Tijdschr. Ned. Ind., vol. 17, p. 82, 1858; not Brunetti, Rec. Indian Mus., vol. 25, p. 61, 1923, and elsewhere.

*Wallacea splendida* HARDY, Proc. Linn. Soc. New South Wales, vol. 58, p. 410 1933 (new synonymy).

This species is widely distributed, being known from Amboina, its type locality, to Queensland, Australia. I have compared the Solomon Islands material with specimens from New Guinea, New Hebrides, and Queensland, and find them to be conspecific. The Indian species,

which Brunetti misinterpreted as this one, is quite different. Additional records: GUADALCANAL ISLAND: 12 females, 10 males, December 6, 1944, and January 6, 1945 (Berg); 17 females, 8 males, 1944 and 1945 (Berg); 1 female, Lunga River Valley, October 3, 1944 (Laffoon). BOUGAINVILLE ISLAND: 2 females, 1944 (Downs). NEW GEORGIA ISLAND: 1 female, Munda Point, 1943 (Downs).

### Genus PEGADOMYIA Kertész

*Pegadomyia* KERTÉSZ, Ann. Mus. Nat. Hungarici, vol. 14, pp. 182-183, 1916.

Two species of this genus have been described previously, *P. pruinosa* Kertész 1916, the genotype, from Formosa, and *P. glabra* Bezzi 1927, from Fiji. The following key, based on the descriptions, will separate these species from the one described below.

1. Thorax including scutellum in large part covered with whitish tomentum; wing blackened on basal, brownish hyaline on apical half.

*pruinosa* Kertész, ♂ ♀

Thorax bare of tomentum, shining or subshining; wing hyaline, veins on basal half, however, distinctly darker than those on apical half----- 2

2. Broad margin of scutellum without tubercles; hind femur broadly reddish on basal half; hind tibia broadly yellowish in middle; abdomen shining black; area of larger upper facets of eye of male sharply divided from area of smaller lower facets-----*glabra* Bezzi, ♂

Broad margin of scutellum with numerous small tubercles arranged in several irregular transverse rows; all femora and tibia wholly black; abdomen black in female, reddish in male; upper facets of eye of male distinctly larger than lower ones, but the two zones not sharply separated.

*nuda*, new species, ♀ ♂

### PEGADOMYIA NUDA, new species

*Female*.—Head wholly black, broad, its width about 1.7 times its height. Front subshining, the upper part about 0.2 head width, parallel-sided, finely punctured, bare, the lower third abruptly broadening toward antennae, obliquely striated, and bare except for a transverse band of silvery tomentum, narrowly interrupted medially, on its upper part. Face with a small area of short silvery pile on each side below antennae. Proboscis, cheeks, and occiput with short scattering hairs which appear brownish but change in color with the light incidence. Antennae brownish, tending to blackish on basal segments and to reddish on flagellum; arista brownish. Proboscis large, black.

Thorax black, shining to subshining; mesonotum and scutellum strongly convex, rather coarsely and evenly punctured; scutellum about 0.45 length of mesonotum, margined and with several irregular transverse rows of small denticles on the margin; pleura, especially mesopleura, with numerous striations in the integument that suggest a fingerprint pattern. Thorax without pruinosity or tomentose areas;

a few scattered inconspicuous hairs on supraalar mesonotal slopes and on sternopleura.

Halteres yellow. Middle and hind tarsi yellow, becoming brownish on apical two or three segments and blackish at extreme apex; legs otherwise wholly black. Front femur, tibia, and tarsus distinctly enlarged but not elongated. Basitarsi of all legs longer than remaining segments combined. Middle femur with some brownish erect hairs on the posterior surface; legs otherwise with only indistinct short appressed hair. Wings hyaline, veins brownish toward base, yellowish along costal half toward the apex, and colorless on the posterior apical section.

Abdomen black shining, broad, short, curling under at apex on dried specimens; segmental divisions indistinct. Length, about 3 mm.

*Male*.—Eyes broadly contiguous; upper facets larger than lower, the one area merging into the other. Frontal tomentose area present as in female, but greatly reduced in size. Abdomen reddish and without so strong a tendency to curl under as in the female. Otherwise differs only sexually.

*HOLOTYPE*.—Female, Guadalcanal Island, from larvae collected October 28, 1944 (Berg); U.S.N.M. No. 57312.

*Allotype*.—Male, same data.

*Paratypes*.—Thirty-four males and 37 females, same data; 1 male, Poha River, Guadalcanal Island, November 3, 1944 (Laffoon); 1 female, Namatanai, New Ireland, February 26, 1940 (G. F. Gee), D 514.

#### Genus *ACYROCERA* Lindner

*Acyrocer*a LINDNER, Ann. Mag. Nat. Hist., ser. 10, vol. 20, pp. 389–390, 1937.

#### *ACYROCERA ARGYRASPI*s Lindner

*Acyrocer*a *argyraspis* LINDNER, Ann. Mag. Nat. Hist., ser. 10, vol. 20, p. 391, 1937.

In both specimens examined by me the coloration is practically the same, except that the halteres are completely infuscated in the female. The scutellum is slightly, though distinctly, notched at the apex, between the apical pair of spines. Veins  $M_1$  and  $M_2$  are slightly separated at their points of origin, thus differing from the condition described and illustrated by Lindner; however, this character is of minor importance and is variable in related genera. In the female the front, at its narrowest, is about one-sixth the head width.

Described from a unique male from Guadalcanal Island. Additional records: GUADALCANAL ISLAND: 1 male 1944 (Berg). BOUGAINVILLE ISLAND: 1 female, April 10, 1944 (Downs).

#### Genus *LEVEROMYIA* Lindner

*Leveromyia* LINDNER, Ann. Mag. Nat. Hist., ser. 10, vol. 20, pp. 391–392, 1937.

**LEVEROMYIA GENICULATA Lindner**

*Leveromyia geniculata* LINDNER, Ann. Mag. Nat. Hist., ser. 10, vol. 20, pp. 392–394, 1937.

Only the female has been described. The two sexes are quite similar to each other; in the male the front is slightly narrower than the width of the ocellar triangle; in the female it is distinctly broader.

Described from Guadalcanal Island, and subsequently recorded by Lindner from San Cristobal Island. Additional records: GUADALCANAL ISLAND: 9 females, 27 males, January 28 and February 2, 1945 (Berg); Lunga River Valley, 1 female, 2 males, October 3 and 27, 1944 (Laffoon).

**Genus EVAZA Walker**

*Evaza* WALKER, Proc. Linn. Soc. London, vol. 1, p. 109, 1857.

**EVAZA SOLOMONENSIS SOLOMONENSIS Curran**

*Evaza solomonensis* CURRAN, Proc. California Acad. Sci., ser. 4, vol. 22, pp. 12–13, 1936.

Described from a male and a female from Vella Lavella Island and subsequently recorded by Lindner from San Cristobal, New Georgia, Savo, Tulagi, Guadalcanal, and Malaita Islands. Lindner did not distinguish between the forms *solomonensis* and *incidens*, which he considered absolute synonyms. Curran originally described these two, together with a third, *whitneyi*, as distinct species. Though I have not seen typical *solomonensis*, the material before me seems to justify the maintenance of the three forms as geographical races.

**EVAZA SOLOMONENSIS INCIDENS Curran**

*Evaza incidens* CURRAN, Proc. California Acad. Sci., ser. 4, vol. 22, p. 13, 1936.

Described from two females from Choiseul Island. Additional records: BOUGAINVILLE ISLAND: 3 females, 1 male 1944 and April 10, 1944 (Downs); 4 males, 1 female, July to September 1944 (Gurney); 2 females, caught in vegetation around pond, July 1, 1944 (Gurney); 1 female, Empress Augusta Bay, March 1944 (Downs) and 3 females, 1 male (Downs). NEW GEORGIA ISLAND: 1 female, Munda Point (Downs).

**EVAZA SOLOMONENSIS WHITNEYI Curran**

*Evaza whitneyi* CURRAN, Proc. California Acad. Sci., ser. 4, vol. 22, pp. 13–14, 1936.

Originally described from one male from Malaita Island. Additional records: GUADALCANAL ISLAND: 10 males, 16 females (January to April 1945 (Berg); 2 males, 1 female, 1944 (Ernest Reinschissel); 2 males, Lunga River Valley, September 6 and October 12, 1944 (Laffoon); 1 female, Umasami River, November 15, 1944 (Laffoon). FLORIDA ISLAND: 1 male, 1 female (Bohart).

Genus **SALDUBA** Walker

*Salduba* WALKER, Proc. Linn. Soc. London, vol. 3, p. 79, 1859.

**SALDUBA LUGUBRIS** Walker

*Salduba lugubris* WALKER, Proc. Linn. Soc. London, vol. 5, p. 271, 1861.

I am tentatively referring the Solomon Islands specimens to this species, which apparently is quite variable. In the specimens before me the mesonotum is covered with a short whitish (female) or pale yellowish (male) tomentum, broadly interrupted by a median and two submarginal dorsal stripes of black tomentum, which are confluent anteriorly. In this respect the Solomon Islands specimens resemble *diphysoides* Walker. The coloration of the legs differs in the two sexes, the femora of the female being chiefly black and those of the male being brownish yellow. This coloration corresponds essentially to that of the female (*lugubris*) and of the male (*singularis*) as re-described by Brunetti (Rec. Indian Mus., vol. 25, pp. 84-85, 1923), and considered by him as conspecific.

Collecting records: GUADALCANAL ISLAND: 1 male, 6 females, January to April 1945 (Berg); 1 male, Lunga River Valley, December 1943 (Knight); 1 female, Lunga River Valley, September 16, 1944 (Laffoon); 1 male, Poha River, September 3, 1944 (Laffoon); 1 female, Matanikau River Valley, November 9, 1944 (Laffoon). FLORIDA ISLAND: 3 females, 1 male, March 1945 (Bohart). NEW GEORGIA ISLAND: 1 male, April 1944 (Berg).

Genus **LOPHOTELES** Loew

*Lophoteles* LOEW, Berlin. Ent. Zeitschr., vol. 2, p. 110, 1858.

Three of the four known species of *Lophoteles* are recorded from the Solomon Islands, and may be separated by use of my key. The fourth, *L. fascipennis* Kertész, from New Guinea, is a clouded-winged species, like *L. vittipennis* (Lindner), but the clouding occurs chiefly beyond the base of discal cell, extends from the costal almost to the posterior margin, and leaves the broad apex hyaline. As Kertész has pointed out the American *L. pallidipennis* Williston belongs to an entirely different genus.

**LOPHOTELES VITTIPENNIS** (Lindner), new combination

*Saldubella vittipennis* LINDNER, Ann. Mag. Nat. Hist., ser. 10, vol. 20, p. 389, 1937.

In Kertész's key to the pachygasterine genera this species traces to *Lophoteles* and it seems to be congeneric with the other described species.

Described from Guadalcanal and Tulagi Islands. Additional records: GUADALCANAL ISLAND: 1 male, Tengeru District, October 30,

1944 (Beck); 36 males, 20 females, August 1944 to June 1945 (Berg); 2 males, 1 female, Lunga River Valley, September 16 and October 3, 1944 (Laffoon). BOUGAINVILLE ISLAND: 1 male, 2 females, 1944, and April 10, 1944 (Downs); 1 male, 1944 (Gurney); 1 female, Empress Augusta Bay, March 1944 (Downs). FLORIDA ISLAND: 1 female (Bohart).

**LOPHOTELES DENTATA, new species**

*Female*.—Head black. Front narrow, at vertex 0.25, at antennal base 0.20, head width; shining, the ocellar triangle prolonged into a tapering glabrous median area, the rest of front coarsely punctate; facials whitish tomentose, the tomentum extending onto lower angles of front. Pile of front inconspicuous, that of occiput short, scattered, whitish. Antennae reddish; flagellum becoming broadly blackish laterally and apically; arista black, densely black-pilose. Thorax wholly black; mesonotum and scutellum with abundant but short and inconspicuous black tomentum; a pair of narrow whitish tomentose stripes on disc behind suture; each lateral margin of mesonotum, before the suture, with a rather conspicuous patch of silvery tomentum. Propleura white-tomentose; posterior half of each mesopleuron with a conspicuous band of silvery tomentum; sternopleura and metapleura with short, scattered, whitish hairs; other pleural areas glabrous. Scutellum in a plane with mesonotum, with a transverse preapical groove; apex medially produced into a short digitate process, which is about one-fifth length of scutellum and which bears two setiferous dentulae on each side; margin of scutellum with six to eight similar setiferous dentulae on each side of this process. Wings lightly and uniformly infumated; venation essentially as in *L. plumula*. Stalk of halteres yellow, knob blackish. Legs mainly whitish; middle coxae brownish; front femur, except broad base and apex, blackish; middle and hind femora each a preapical black annulus. Pile sparse, whitish. Abdomen 1.33 as long as broad, ovate, almost parallel-sided on segments three and four; wholly black, without pollen, and clothed with short inconspicuous brownish to blackish hairs. Length, 3.5 mm.

*Holotype*.—Female, Florida Island (Bohart), U.S.N.M. No. 58473.

**LOPHOTELES PLUMULA Loew**

*Lophoteles plumula* LOEW, Berl. Ent. Zeitschr., vol. 2, p. 111, 1858.

Recorded by Curran (1936) from Matema and Nupani Reef Islands, of the Santa Cruz group.







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## CYPRINODONT FISHES OF THE GENUS *FUNDULUS* IN THE WEST INDIES, WITH DESCRIPTION OF A NEW SUBSPECIES FROM CUBA

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By LUIS RENÉ RIVAS <sup>1</sup>

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CYPRINODONT fishes of the genus *Fundulus* have been reported from the West Indies since Cuvier and Valenciennes (1846, p. 198) described *F. fonticola* from the fresh waters of Puerto Rico. More recently, Fowler (1916, p. 418) described *F. antillarum* from the Island of St. Martins. A third form (*F. grandis saguanus*), described as new in the present paper, was collected by me in north-central Cuba. The cyprinodont described from western Cuba by Eigenmann (1903, p. 222, fig. 1) as *Fundulus cubensis*, is the type of *Cubanichthys* Hubbs (1926, p. 4), a genus allied to *Chriopeops* (Fowler, 1916, p. 425) of Florida and not closely related to *Fundulus*.

Until now most authors have doubted the existence of *Fundulus* in the West Indies. *Fundulus fonticola* is known only from the type specimens, despite extensive collecting in the waters of Puerto Rico (Evermann and Marsh, 1902; Nichols, 1929; Hildebrand, 1935, and others). Hildebrand (1935, p. 49) wrote about *F. fonticola*: "The type and presumably the only known specimen of *F. fonticola*, is reported to have been taken in a mountain spring in Puerto Rico. Poey's record (1881, p. 342) was based on Cuvier and Valenciennes, not on additional specimens as indicated by Evermann and Marsh (1902, p. 97). It is regarded as extremely doubtful whether M. Plée, the collector, actually obtained these fishes in Puerto Rico. Since he

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<sup>1</sup> This paper was prepared at the United States National Museum, at the time the author was engaged in research on West Indian fishes under a John Simon Guggenheim Latin American Fellowship. Marine Laboratory, University of Miami, Contribution No. 15.

collected in other West Indian Islands, it is possible that the place of collection was incorrectly stated." Myers (1938, pp. 358, 360), doubted the existence of either *antillarum* or *fonticola* in the West Indies, pointing out that both were based on old collections, the locality data of which are not above suspicion. The present discovery definitely reestablishes the occurrence of *Fundulus* in the West Indies.

The following letter received by Dr. R. R. Miller from Dr. George S. Myers expresses his views regarding *Fundulus* in the West Indies.

There seems to be no good reason why *Fundulus* should not be found in the West Indies, since several of the species (*heteroclitus*, *grandis*, *luciae*, *similis*, *majalis*) seem in many places to be as happy in salt water as in fresh. *Cyprinodon*, which is also partial to salt and inland alkaline waters, has reached Cuba, Hispaniola, Jamaica, the Bahamas, and Curaçao, and this migration has in part, at least, certainly been independent of former land connections. In my paper on West Indian Zoogeography (1938, p. 345) I pointed out the almost forgotten fact that the *Challenger* collected a *Fundulus* in a pelagic haul made in the mid-Atlantic.

Under these circumstances, it seems very strange that the only two records of *Fundulus* in the West Indies are based on old collections the data on which is open to suspicion. *Fundulus fonticola* Cuvier and Valenciennes (1846) was based on several specimens supposedly collected in Puerto Rico at a time when locality data were seldom given fully, and by a man (Plée) whose West Indian collections were very frequently mislabelled. When Jordan re-examined the types (1887, p. 526) he found all of them save the largest to be some sort of viviparous poeciliid; he says "apparently *Gambusia*." If they were *Gambusia*, it is certain they did not come from Puerto Rico, and the largest specimen, which alone was a *Fundulus*, probably did not, either. Fowler's *F. antillarum*, said to be from St. Martins, was based on types forming part of the van Rijgersma collection, which lay about in the Academy of Natural Sciences of Philadelphia for many years without being reported on. Other collections that similarly lay about for many years in the Academy, at a time when there was not an active ichthyological curator, had the data confused (witness Cope's supposed West African *Fundulus nisorius*, which is nothing but North American *heteroclitus*), and I seriously doubt the locality data of *antillarum*. I believe that I made an attempt at one time to see the types, but I am not sure. At least I know I never saw them, and I doubt their real distinctiveness from *heteroclitus*.

The fact that Rivas has discovered a new *Fundulus* in Cuba, however, puts a different light on *antillarum*, although I think it has no bearing on *fonticola*, the existence of which in Puerto Rico seems to be definitely disproved by Hildebrand's extensive work on that island. Now that we know that a *Fundulus* exists in Cuba, *antillarum* becomes slightly less difficult to believe, although little of the doubt regarding the data of those old Academy collections is dissipated by the Cuban discovery. My principal question is why such an aggressive fish as *Fundulus*, once in the West Indies, has not spread and become as ubiquitous as it is along coastal North America. I believe I expressed this same question in my 1938 Smithsonian paper, but an answer occurs to me. Excepting for *Orestias* in Lake Titicaca, the genus *Fundulus* inhabits colder water than any other genus of the family, and it scarcely enters the tropics at all. On the Pacific coast it reaches only to central Baja California, and on the Atlantic only to Yucatan. More southerly records are myths, or are based on *Profundulus* or other genera. Hubbs has shown the Cape San Lucas species to be nonexistent.

The chief limiting factor has almost certainly been water temperature. It seems probable that there have been numerous overseas colonizations of *Fundulus* in the Antilles from North America, especially during the colder parts of the Pleistocene, for the genus is exceedingly abundant along the continental shores of the Gulf of Mexico, but it is likely that the warmer waters of the islands have proved to be unsuitable to these northerly fishes. It would be interesting to know whether the waters where Rivas' new *Fundulus* occurs is in general cooler than in other similar Cuban habitats. *Cyprinodon* would seem to be able to stand warmer water than *Fundulus*, for it has reached the southern Caribbean and exists in desert hot springs where no *Fundulus* would survive.

Through the assistance of Dr. Leonard P. Schultz, detailed measurements and counts of the type specimens of *Fundulus fonticola* were kindly sent from the Paris Museum by Dr. Paul Chabanaud. These show that the species was based on seven specimens 18.5 to 42 mm. in standard length, of which only three (22, 23, and 42 mm.) belong to the genus *Fundulus*. These three specimens have 12 or 13 dorsal rays and 34 transverse rows of scales. They agree in these and other counts and proportions with forms of the *F. heteroclitus* group from northern Florida. The four remaining specimens have 7 or 8 dorsal rays and 32 transverse rows of scales, and they could very well be poeciliids of the genus *Gambusia*, as Jordan (1887, p. 526) suggested. Dr. Chabanaud also sent a photograph (pl. 14) of the largest specimen, which he has designated (in litt.) as the lectotype of the species. This photograph has been examined by Doctors Hubbs and Myers, and they agree that it represents a species of *Fundulus*.

*Fundulus antillarum*, known only from the two type specimens, is closely related to *F. heteroclitus* if it is not the same, as Fowler (1916, p. 420) originally indicated. The only differences he described are those of minor details of the coloration, the variation of which may have been due to the method and time of preservation. Hubbs (1926, p. 7) suggested that *F. antillarum* is a synonym of *F. fonticola*, which he provisionally recognized as a subspecies of *F. heteroclitus*. The Cuban *Fundulus* is regarded as only subspecifically distinct from *F. grandis* of southern Florida.

As discussed below in more detail, *Fundulus* probably reached the West Indies (Cuba) from southern Florida, during the Pleistocene, via Cay Sal Bank. It is to be expected that any *Fundulus* occurring in Puerto Rico (*F. fonticola*) or St. Martins (*F. antillarum*) would be related to *F. grandis saguanus* and *F. grandis grandis* from north-central Cuba and southern Florida, respectively, rather than to *F. heteroclitus*, which inhabits the northern half of the peninsula of Florida.

The "mountain spring" in Puerto Rico, where *F. fonticola* is supposed to have been collected, does not seem to be the proper habitat for a *Fundulus* of the *heteroclitus* and *grandis* group. These forms in-

habit shallow, salt, or brackish coastal waters where the bottom is composed of mud. It is not known whether *F. antillarum* was collected in salt, brackish, or fresh water.

The identities of *F. fonticola* and *F. antillarum* cannot be definitely established until a comparative study of specimens is made. During a recent visit to the Academy of Natural Sciences of Philadelphia I intended to study the type specimens of *F. antillarum*, but Henry W. Fowler, curator of fishes, was unable to locate them.

*Methods of study.*—Measurements are expressed as the number of times a given part is contained in the standard length, measured from the tip of the snout (anterior tip of upper lip) to the caudal base; the head length, from the tip of the snout to the extreme bony margin of the opercle; or in other base lengths such as the postorbital, interorbital, predorsal, and caudal peduncle. The postorbital was measured between the posterior fleshy margin of the orbit and the extreme bony margin of the opercle. The interorbital was considered as its least fleshy width. The predorsal length was measured from the tip of the snout to the origin of the dorsal fin. The length of the caudal peduncle is the distance between the end of the anal base and the middle of the caudal fin base. The width of the mouth was considered as the overall width, including the lips. All measurements were made and stepped off with fine-pointed dividers.

The last ray of the dorsal and anal fins was considered as a double ray split to the base. All pectoral and pelvic rays were counted as single rays. The transverse scale rows were counted from the upper end of the opercular margin to the caudal base; the longitudinal rows were counted between the dorsal and anal bases, not including the irregular rows immediately above the anal origin. Other measurements and counts used in this paper are self explanatory.

Throughout the description the measurements and counts of the holotype are given first, followed in parentheses by those of the female and male paratypes, separated by a semicolon.

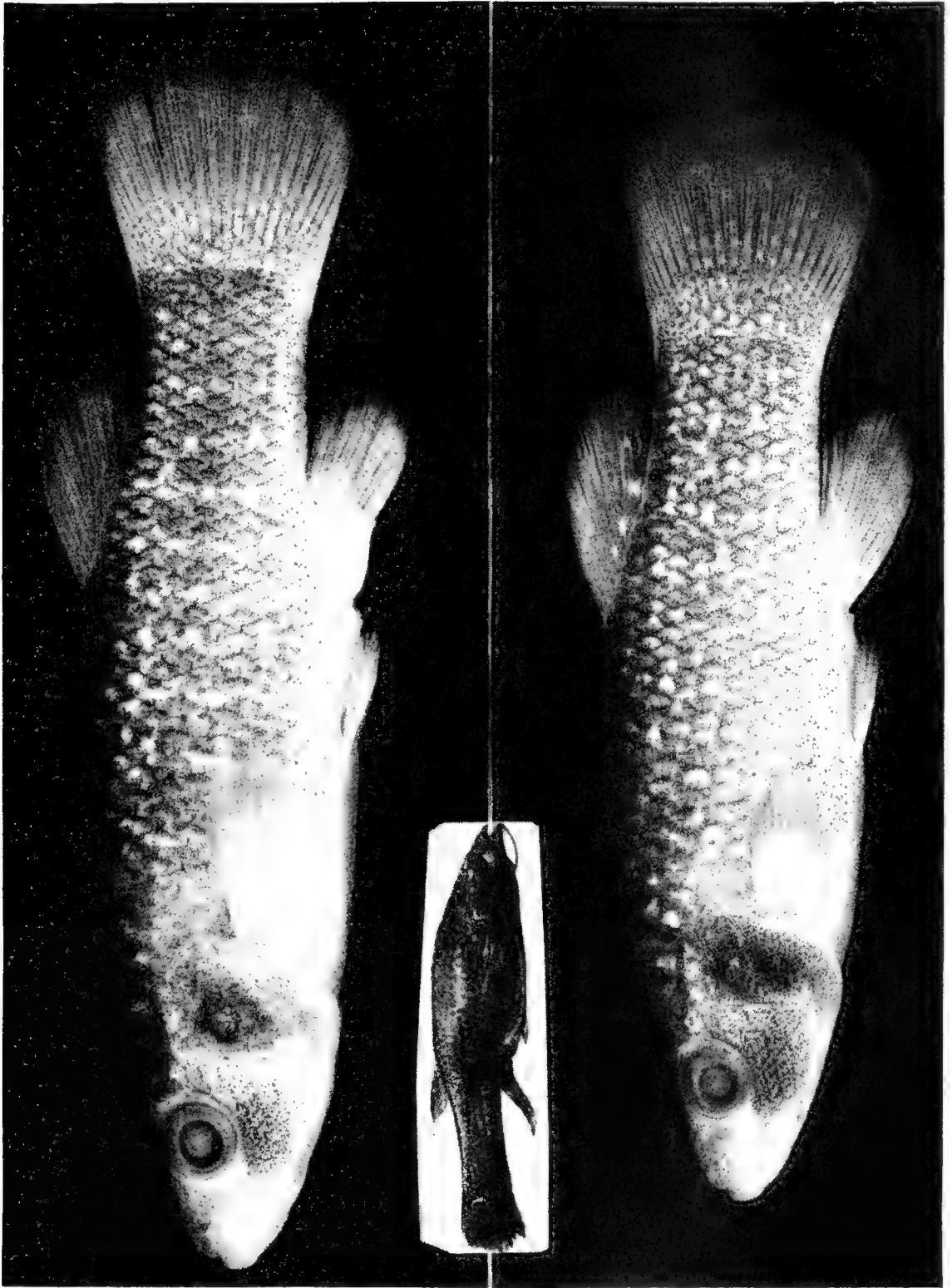
Drs. Leonard P. Schultz and Robert R. Miller, of the U. S. National Museum, have kindly checked the composition of the manuscript, offering valuable suggestions. I am very grateful to the Sánchez family of Central Resulta, Sagua La Grande, for their kind hospitality and help during my stay in that region.

**FUNDULUS GRANDIS SAGUANUS, new subspecies**

GUASABOLO

PLATE 14

*Description.*—Greatest depth of body 3.6 (3.5 to 3.8; 3.2 to 3.6) in standard length, 1.1 (1.1 or 1.2; 1.1 or 1.2) in head. Head 3.0 (2.8 to



*Fundulus grandis saguanus*, new subspecies: Female holotype (left), 75 mm. in standard length, and male paratype (right), 65 mm., from Playa Uvero, Province of Las Villas, Cuba; photographed in Smithsonian Photographic Laboratory. Insert: *Fundulus fonticola* Cuvier and Valenciennes, from the lectotype, 42 mm. in standard length; photograph courtesy of Dr. Paul Chabanaud, Musée d'Histoire Naturelle, Paris.



3.0; 2.7 to 2.9) in standard length, its greatest width 1.0 (1.0 or 1.1; 1.0 or 1.1) in length of caudal peduncle. Origin of dorsal fin to tip of snout 1.5 (1.4 or 1.5; 1.4 or 1.5) in standard length. Origin of dorsal fin to caudal base 2.8 (2.6 to 2.9; 2.6 to 2.8) in standard length. Origin of anal fin to mandible tip, 1.4 (1.3 or 1.4; 1.3 or 1.4) in standard length. Origin of anal fin to caudal base 2.9 (2.8 to 3.0; 2.9 or 3.0) in standard length. Insertion of pelvic fin to anus 2.5 (2.5 to 2.9; 2.7 to 3.0) in head. Distance between origins of dorsal and anal fins 1.2 (1.2 or 1.3; 1.2 or 1.3) in head. Length of caudal peduncle 4.5 (4.1 to 4.5; 4.1 to 4.4) in standard length, 1.5 (1.3 to 1.5; 1.4 to 1.6) in head, 3.0 (2.7 to 3.0; 2.7 to 2.9) in predorsal length; its least depth 2.0 (2.0 to 2.2; 1.9 to 2.1) in head; 1.3 (1.2 to 1.4; 1.1 to 1.3) in its length. Horizontal diameter of orbit 4.3 (3.7 to 4.4; 4.0 to 4.4) in head, 1.9 (1.5 to 1.9; 1.7 to 2.0) in interorbital, 1.9 (1.5 to 1.9; 1.7 to 2.0) in postorbital. Interorbital 2.4 (2.2 to 2.4; 2.1 to 2.3) in head, 1.5 (1.5 or 1.6; 1.4 to 1.6) in length of caudal peduncle. Snout 3.0 (2.9 to 3.2; 3.0 or 3.1) in head. Width of mouth 2.7 (2.6 to 3.0; 2.7 or 2.8) in head, 1.1 (1.1 or 1.2; 1.1 or 1.2) in interorbital.

Dorsal fin 1.4 (1.3 to 1.7; 1.2 to 1.5) in head; anal 1.6 (1.6 to 1.9; 1.5 to 1.7); pectoral 1.9 (1.8 to 2.0; 1.8 to 2.1); pelvic 3.0 (2.8 to 3.0; 2.7 to 3.0); middle caudal rays 1.3 (1.3 or 1.4; 1.3 or 1.4).

Dorsal rays 11 (10 or 11, usually 11; 10 to 12); anal 10 (9 or 10, usually 10; 9 or 10, usually 10); pectoral 16 (16 to 18, usually 17; 17 or 18, usually 17); pelvic 6; branched caudal 16 (16 to 18; 16 to 18). Scales in 32 (32 or 33; 32 or 33) transverse rows, and 9 longitudinal rows; predorsal scales 16 (16 to 18; 16 or 17); suborbital scales in 5 (4 or 5; 4 or 5) rows. Gill rakers 7 to 9, usually 8 on lower limb of first arch.

Coloration as in *Fundulus grandis grandis* (Jordan and Evermann, 1896, p. 642). The specimens were killed and fixed in 10 percent formalin and later transferred to 70 percent alcohol.

*Types*.—The holotype, U.S.N.M. No. 132419, is an adult female 75 mm. in standard length, collected by Luis René Rivas in a brackish-water channel at Playa Uvero, about 18 km. northeast of Sagua La Grande (hence the name *saguanus*), Province of Las Villas, Cuba (latitude 22°51' N., longitude 79°54'40'' W.), on August 13, 1945. The paratypes, U.S.N.M. No. 132420, seined with the holotype, comprise 9 half-grown and adult females 38 to 65 mm., and 5 adult males 49 to 65 mm.

The type specimens have been deposited in the United States National Museum.

This subspecies differs from *Fundulus grandis grandis* in the deeper and shorter caudal peduncle, longer head, broader interorbital, fewer pectoral rays and scales, as shown in table 1 and the following key.



- 1a. Least depth of caudal peduncle 1.5 to 1.8, usually 1.6 or 1.7 in its length, which is contained 1.1 to 1.4, usually 1.2 or 1.3 times in the head. Head 3.0 to 3.3 in standard length. Interorbital 1.6 to 2.0, usually 1.7 to 1.9 in length of caudal peduncle. Pectoral rays 16 to 20, usually 18 or 19. Scales in 34 to 37, usually 35 or 36 transverse rows----- *Fundulus grandis grandis*
- 1b. Least depth of caudal peduncle 1.1 to 1.4, usually 1.2 or 1.3 in its length, which is contained 1.3 to 1.6, usually 1.4 or 1.5 times in the head. Head 2.7 to 3.0 in standard length. Interorbital 1.4 to 1.6, usually 1.5 or 1.6 in length of caudal peduncle. Pectoral rays 16 to 18, usually 17. Scales in 32 or 33 transverse rows----- *Fundulus grandis saguanus*

The close relationship between *Fundulus grandis grandis* and *F. grandis saguanus* is shown by a critical comparative study of both forms. They more or less overlap in the distinguishing characters given in the above key, except for the transverse rows of scales, but table 1 indicates that more adequate material of *saguanus* will show overlap also in this character. For these reasons I think it best to consider *saguanus* as only subspecifically distinct from *grandis*, rather than to assign it full specific rank. Both forms have apparently the same habits and inhabit calm, shallow, coastal waters.

In comparing the new subspecies with specimens of *F. grandis grandis* from several localities (Florida Keys to Texas) along its range, it was found that *grandis* exhibits a number of variations of geographical significance. This subspecies may be shown to be a complex of local races if subjected to a critical study of variation throughout its range. The Cuban subspecies, *saguanus*, is most closely related to the race of *grandis* occurring in the Florida Keys.

The common ancestry of *Fundulus grandis grandis* and *F. grandis saguanus* is well established by their close relationship and vicarious distribution, and by their similar habits and habitat. These facts, correlated with the paleogeography of the region comprising southern Florida and north-central Cuba, suggest that the ancestors of *saguanus* probably migrated to Cuba from southern Florida, via Cay Sal Bank, during the Pleistocene.

Such a migration would not be difficult to conceive even during recent times, since the width of the Strait of Florida between the Keys and Cay Sal Bank (about 50 nautical miles) and that of Nicholas Channel between Cay Sal Bank and Cuba (about 20 nautical miles) is not very great. In my opinion, it would not be impossible for such a fish as *Fundulus* to cross these relatively narrow channels. But the fact that the populations of the Florida Keys and Cuba have differentiated, at least subspecifically, indicates that such an exchange of individuals is not actually taking place between the two regions. Much better conditions for this migration, however, existed during the Pleistocene when the level of the ocean was much lower, caused by waters impounded as ice on the poles. According to Daly (1934, p.

47) sea level was about 42 fathoms lower at that time. This would have narrowed the channels somewhat, and made Cay Sal Bank wholly emergent and a much better stepping stone for a *Fundulus* migrating from Florida to Cuba.

Whether a *Fundulus* exists in Cay Sal Bank I cannot say. To my knowledge that area has never been thoroughly explored ichthyologically. There are some small keys and islets such as Elbow, Dog, Damas, Salt, and others bordering the Bank, the average depth of which is about 4 fathoms. If *Fundulus* actually migrated to Cuba via Cay Sal Bank there is no reason why a fish of this genus should not occur there.

Although *Fundulus grandis saguanus* is as yet known only from the type locality it will probably be found to occur throughout the continuous shallow bank extending along the coast of north-central Cuba, from the Hicacos Peninsula in the Province of Matanzas, to Punta Maternillos in the Province of Camagüey.

TABLE 1.—*Frequency distribution of pectoral rays and transverse rows of scales in Fundulus grandis grandis and F. grandis saguanus*

Subspecies	Pectoral rays					Transverse rows of scales					
	16	17	18	19	20	32	33	34	35	36	37
<i>F. grandis grandis</i> .....	1	2	13	5	1	-----	-----	2	10	7	3
<i>F. grandis saguanus</i> .....	1	12	2	-----	-----	7	8	-----	-----	-----	-----

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# A NEW CRAYFISH OF THE GENUS CAMBARUS FROM TEXAS, WITH NOTES ON THE DISTRIBUTION OF CAMBARUS FODIENS (COTTLE)

By HORTON H. HOBBS, JR.

THE new crayfish herein described is a member of the Diogenes section, a rather advanced assemblage of species belonging to the genus *Cambarus*. The Diogenes section is defined by Ortmann (1931, p. 146) as follows: "Carapace ovate, compressed, and without lateral spines. Rostrum without marginal spines. Chelae short, ovate, broad, and depressed. Areola very narrow or obliterated (linear) in the middle, always distinctly longer than one third of the carapace. Eyes well developed."

Specimens of this undescribed species have been previously collected and identified as *Cambarus argillicola* Faxon [= *C. fodiens* (Cottle, 1863, p. 217)], and while there are a number of references to it in the literature, most of them are repetitions of a few locality records. The synonymy listed below is as nearly complete as I have been able to ascertain.

My interest in the problem of the distribution of *C. fodiens* was aroused several months ago when Joel W. Hedgpeth, of the Institute of Marine Science, Port Aransas, Tex., sent two crayfishes from the Aransas Refuge to the United States National Museum for determination. Upon comparing these crayfishes with specimens of *C. fodiens* it was found that they belonged to an undescribed species. In order to determine the range of this new form it was necessary to attempt to clarify a few of the questions that had arisen in the literature as to the range of *C. fodiens* and my conclusions are presented at the end of this paper.

I wish to express my appreciation to Mr. Hedgpeth, in whose honor this species is named, for obtaining additional specimens for me. I also wish to thank Dr. Waldo L. Schmitt and Dr. Fenner A. Chace, Jr., both of the United States National Museum, for their kindness in making the Museum collection accessible and for checking the manuscript of this paper.

Genus *CAMBARUS* Erichson. 1846

*CAMBARUS HEDGPETHI*, new species

FIGURE 17

*Cambarus argillicola* FAXON, 1884, p. 116, in part, p. 144, in part; 1885, p. 77, in part; 1898, p. 650, in part; 1914, p. 400, in part.—HARRIS, 1903, p. 59, in part, p. 71, in part, p. 137, in part, p. 158, in part, pp. 144, 150, 153, in part, pl. 3, in part.—HAY, 1899, p. 959, in part.—(?) LYLE, 1938, p. 76.—ORTMANN, 1902, p. 280; 1905, p. 123, in part, p. 136, in part.—TURNER, 1926, p. 187, in part).

*Cambarus fodiens* CREASER, 1931, p. 269, in part; 1932, p. 336, in part.—PENN, 1941, p. 8.

*Diagnosis*.—Rostrum without lateral spines; areola obliterated in middle; chela strongly depressed with a prominent tuft of plumose setae along base of opposable margin of immovable finger; mesial process of first pleopod of first-form male so grooved as to appear slightly twisted. It may be readily distinguished from its closest relatives, *C. byersi* Hobbs (1941, p. 118) and *C. fodiens*, as follows: In *C. byersi* there is no tuft of setae along the base of the opposable margin of immovable finger; however, there is a row of long setae along the outer lower surface of the hand which is not present in *C. hedgpethi*. In *C. fodiens* there is a single major tubercle on opposable margin of immovable finger, and in *C. hedgpethi* there are two major tubercles.

*Holotypic male, form I*.—Body subcylindrical. Abdomen narrower than thorax (11.1–13.4 mm. in widest parts, respectively).

Width of carapace slightly greater than depth in region of caudodorsal margin of cervical groove (13.1–12.9 mm.). Greatest width of carapace slightly caudad of caudodorsal margin of cervical groove (13.4 mm.).

Areola obliterated in middle; cephalic section of carapace about 1.5 times as long as areola (length of areola about 40 percent of entire length of carapace).

Rostrum directed cephaloventrad; upper surface deeply excavate cephalad; margins converge gently from base and turn somewhat abruptly mesiad at base of acumen; acumen not distinctly set off from rest of rostrum; no lateral spines present; tip of rostrum bears an acute upturned tubercle and extends to distal end of penultimate segment of peduncle of antennule. Sparsely punctate above at base and

with a row of setiferous punctations along inner margins of lateral ridges; rostral ridges not much inflated and extend cephalad to apex of rostrum. Subrostral ridges weak. Postorbital ridges low and terminate cephalad without a spine. Suborbital angle absent. Branchiostegal spines minute.

Surface of carapace punctate dorsad and slightly granulate laterad. Abdomen slightly shorter than carapace (25.5–26.8 mm.).

Cephalic section of telson with one spine in the right and two in the left caudolateral corners.

Epistome with cephalolateral margins rounded. No cephalomedian projection.

Eyes normal.

Antennules of the usual form; a spine present on ventral side of basal segment.

Antennae broken (see description for morphotypic male). Antennal scale small (fig. 17, *i*); outer distal portion bearing a strong spine; lamellar portion comparatively broad, broadest distad of middle; inner margin rounded.

First left pereopod (dactyl on right pereopod broken) strongly depressed, palm slightly inflated. Fingers only slightly gaping with tip of dactyl passing beneath tip of propodus, when fingers are brought together, to a greater degree than in most crayfishes. Hand punctate above and below; mesial margin with a row of six or seven well-defined tubercles subtended dorsad by a weaker row of five tubercles. Outer margin of hand with a distinct ridge. One tubercle present along articulation of movable finger on lower surface of hand.

Opposable margin of dactyl of first left pereopod with a single row of minute denticles along distal third, and a row of seven tubercles, third from base the largest, on proximal two-thirds. An excision occurs just proximad of the largest tubercle. A distinct submedian ridge flanked on either side by a row of setiferous punctations present on upper surface of dactyl. Mesial margin with a row of 10 tubercles along basal two-thirds and 5 setiferous punctations on distal third; a row of 5 smaller tubercles on proximal fourth immediately above the larger tubercles just mentioned. Lower surface of dactyl with a submedian ridge flanked proximally by a row of setiferous punctations on either side.

Opposable margin of immovable finger of first left pereopod with a single row of minute denticles along distal third, and a row of five tubercles, the proximal two the largest on proximal two-thirds (in some specimens there is a small tubercle proximal to the more proximal large one); a distinct ridge present from base of finger to second large tubercle. Upper surface with a submedian ridge flanked on each side by a row of setiferous punctations with a number of very deep ones laterad of base. Lateral margin keeled with a row of setiferous

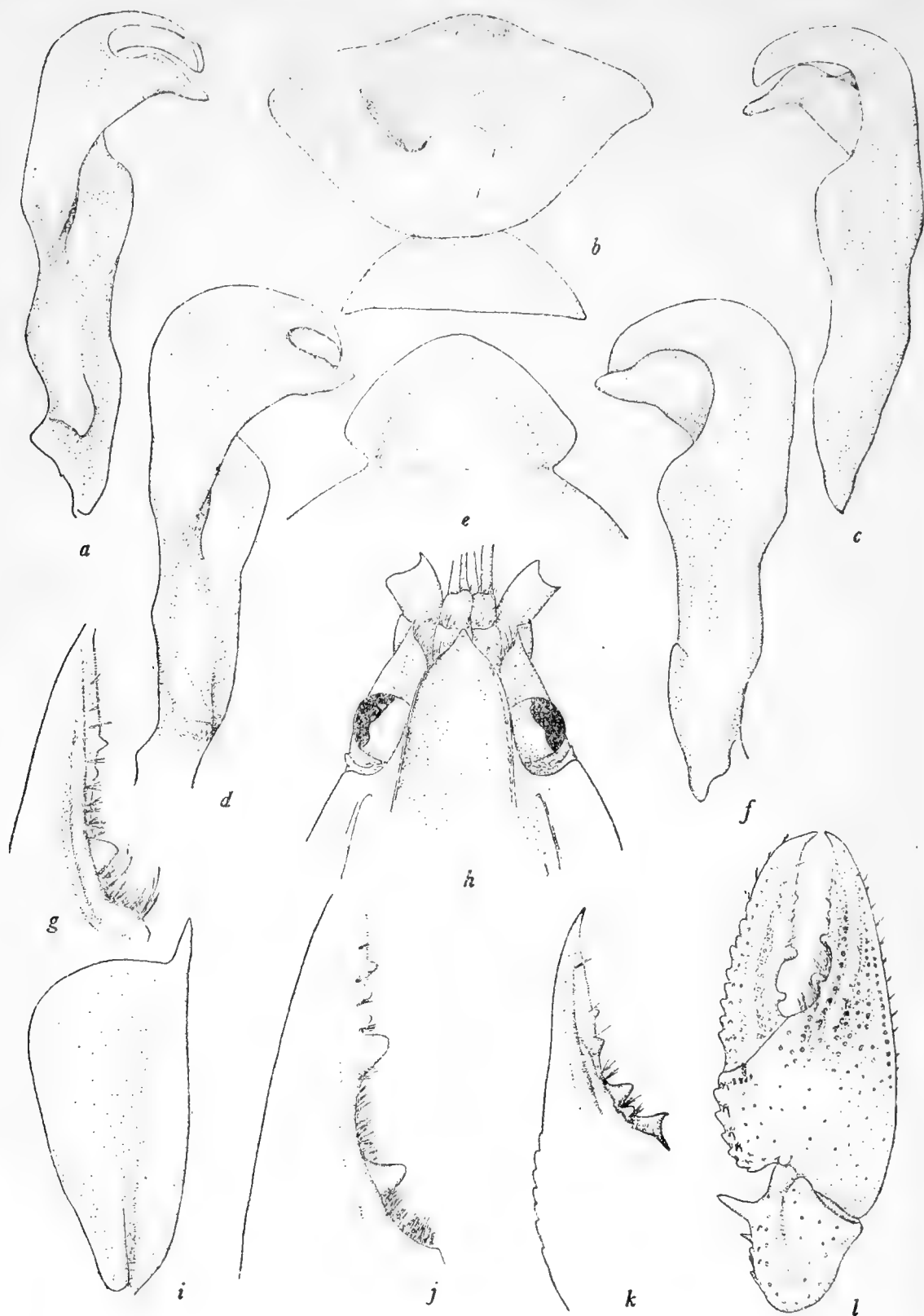


FIGURE 17.—*a-f, h-j, l, Cambarus hedgpethi*: *a*, Mesial view of first pleopod of first-form male; *b*, annulus ventralis; *c*, lateral view of first pleopod of first-form male; *d*, mesial view of first pleopod of second-form male; *e*, epistome; *f*, lateral view of first pleopod of second-form male; *h*, cephalic portion of carapace; *i*, antennal scale; *j*, upper surface of immovable finger; *l*, chela. *g, C. fodiens*: Upper surface of immovable finger of specimen from Washtenaw County, Mich. *k, C. byersi*: Upper surface of immovable finger of specimen from Escambia County, Fla.



punctations on either side of keel. Lower surface with a mesial keel, otherwise punctate; immediately mesiad and above the keel is a mat of plumose setae.

Carpus of first left pereiopod longer than wide, longer than inner margin of palm of chela; well-defined longitudinal furrow above. Lateral portion of upper surface and lateral surface punctate; mesial portion of upper surface with a group of nine small tubercles, below which is a row of four larger ones, the distal member of this row decidedly larger than the others and spikelike; lower mesial margin with five small tubercles and the lower cephalic margin with two large ones.

Merus of first left pereiopod sparsely punctate mesiad and laterad. Lower mesial margin with 13 tubercles, the penultimate the largest; lower lateral margin with five small ones. Upper margin of merus emarginate with two small tubercles slightly proximad of distal margin, and a transverse row of three small ones on distal margin.

Margins of maxillipeds and second pereiopods bearing long hairs.

Hooks present on ischiopodites of third pereiopods only; hooks slender.

First pleopod reaching to base of third pereiopods and terminating in two distinct parts. Central projection corneous and bladelike, recurved at slightly greater than a right angle to the main shaft; caudodistal margin entire. Mesial process grooved so as to appear twisted, not bulbous, and lies parallel to the central projection.

*Allotypic female*.—Differs from the holotype in the following respects: Cephalic section of telson with 2 spines in each caudolateral corner. Antennae extend caudad to third abdominal segment. Opposable margin of dactyl with 10 tubercles; however, third from base largest as in holotype. Row of tubercles on upper surface of dactyl above the mesial row consisting of 4 instead of 5. Opposable margin of immovable finger with 4 tubercles. Slight differences in tubercle counts on carpus and merus; however, the larger ones as described for holotype. See fig. 17, *b* for contours of annulus ventralis. The left chela of the allotype is abnormal, perhaps a regenerated one.

*Morphotypic male, form II*.—Differs from the holotype in the following respects: Cephalic section of telson with 2 spines in each caudolateral corner. Antennae extend caudad to third abdominal segment. Opposable margin of dactyl with 8 or 10 tubercles, one decidedly larger than the others in the same position as in holotype. Mesial margins of dactyls with 9 or 10 tubercles. Left dactyl with 6 tubercles in the row above mesial row. Opposable margin of immovable finger with 4 tubercles, the proximal 2 larger as in holotype. Slight differences in tubercle counts on carpus and merus; however, the larger ones as described for holotype. First pleopod differing from that of holotype in that there is less twist to the mesial process, and the central projec-

tion noncorneous and somewhat inflated. Hooks on ischiopodites of third pereopods much reduced.

*Measurements*.—Holotype: Carapace height 12.9, width 13.4, length 26.8 mm.; areola width 0.0, length 10.7 mm.; rostrum width 3.8, length 4.9 mm.; abdomen length 25.5 mm.; left chela, length of inner margin of palm 5.7, width of palm 9.3, length of outer margin of hand 21.4, length of dactyl 15.2 mm. Allotype: Carapace height 13.4, width 13.9, length 29.0 mm.; areola width 0.0, length 11.5 mm.; rostrum width 4.4, length 5.2 mm.; abdomen length 28.5 mm.; right chela, length of inner margin of palm 5.7, width of palm 9.6, length of outer margin of hand 21.2, length of dactyl 15.7 mm.

*Type locality*.—Lower middle part of the Aransas National Wildlife Refuge, Aransas County, Texas. "The Aransas Refuge consists of some 47,000 acres on Blackjack Peninsula, which is bounded by several bays. This low land is fringed with brackish marsh. The gently rolling interior contains much oak brush, mainly live oak (*Quercus virginiana*) and myrtleleaf oak (*Q. myrtifolia*). Blackjack oak (*Q. marilandica*) is also common. Associated species are prickly ash (*Xanthoxylum clava-herculis*) and sweet bay (*Persea bordonia*). Interior grasslands contain swales or 'wet weather' ponds, dominated by little bluestem (*Andropogon scoparius*) and associated grasses of the genus *Paspalum*. These grasslands are dotted with groves or mottes of live oak. Areas around cattle tanks and some fresh water ponds are covered with Bermuda grass (*Cynodon dactylon*)."  
(Stevenson and Griffith, 1946, pp. 161–162.) Mr. Hedgpeth has informed me that the area in which the crayfish were taken from burrows "is often quite damp with runoff ponds, etc., and is separated from a salt marsh area by a low artificial dyke in the form of a road. At times in the spring the mud pillars are a conspicuous feature of the landscape."

*Disposition of types*.—The male, form I, holotype and second-form male morphotype (No. 85146) and the female allotype (No. 85147) are deposited in the United States National Museum. Paratypes, consisting of a first-form male and a female, are in my personal collection at the University of Virginia, H.H.H. No. 5–2147–1.

*Specimens examined*.—TEXAS: *Aransas County*, type locality, January 27, 1947, one male, form I, one male, form II, R. P. Allen, coll.; Aransas Refuge, McHoughs Well, May 21, 1947, one male, form I, one female J. W. Hedgpeth, coll.; Aransas Refuge, San Carlos Field, December 28, 1946, one female, R. P. Allen, coll. *Brazoria County*, Brazoria, one female, U.S.N.M. No. 17280, William Lloyd, coll. *Victoria County*, Victoria, one male, form I, U.S.N.M. No. 17279, William Lloyd, coll. LOUISIANA: *Orleans Parish*, New Orleans, one female, U.S.N.M. No. 2262, G. Kohn, coll. *DeSoto Parish*, Frierson,

one female, U.S.N.M. No. 23551, one male, form I, U.S.N.M. No. 23663, L. S. Frierson, coll.

*Relationships*.—*Cambarus hedgpethi* has its closest affinities with *C. fodiens* and *C. byersi*. It is possible that further collecting between Indiana, Texas, and Alabama will show that intergrades occur among the three.

*Variations*.—Only slight variations were noted among the specimens I have examined. Regenerated chelipeds among them are markedly different from the normal ones; the opposable margins of the fingers bear no large tubercles, and the immovable finger is usually much broader at the base than are those of the normal chelae.

*Remarks*.—Faxon (1885, p. 77) recorded *Cambarus argillicola* (*C. fodiens*) from New Orleans, La., and Kinston, N. C., but stated that the specimens on which these records were based were immature and "cannot be determined with absolute certainty." Faxon (1898, p. 650) listed three localities for *C. argillicola*—two in Texas, Victoria and Brazoria, and one in Mississippi, Bay Saint Louis, Hancock County.

Ortmann (1905, p. 136) stated that "The localities, Kinston, N. Carolina, and New Orleans, Louisiana, given by Faxon in 1885 are doubtful, as admitted by himself. The localities given in 1898, Victoria and Brazoria, Texas (U. S. Mus.), most emphatically need confirmation."

Creaser (1932, p. 336), in summarizing the range of *C. fodiens*, stated with reference to the list of States from which this species had been taken (i. e., Michigan, Lower Ontario, Ohio, Indiana, Illinois, Mississippi, Louisiana, Texas, and North Carolina): "The records for the four States last named are surely doubtful." With the description of *C. hedgpethi* Ortmann's and Creaser's doubts as to the occurrence of *C. fodiens* in Louisiana and Texas have been justified.

The specimens of *C. hedgpethi* I listed above from New Orleans, La., and Brazoria and Victoria Counties, Tex., are the same ones on which Faxon's records of *C. argillicola* were based.

I have also examined the specimen on which Faxon's Mississippi record was based (Bay St. Louis, Hancock County, 1 female, U.S.N.M. No. 17278) and find that this specimen belongs to *Cambarus byersi* Hobbs. While I have not seen the specimen(s) from Kinston, Lenoir County, N. C., I feel certain that *C. fodiens* does not occur in North Carolina. Perhaps the specimen(s) in question belong(s) to the somewhat closely related *Cambarus uhleri* Faxon (1884, p. 116).

The known range of *Cambarus fodiens* extends from Ontario through Ohio, Michigan, Indiana, and Illinois. Creaser (1932, p. 336) pointed out that a search should be made in southern Wisconsin for this species, and it seems probable in the light of the following that

the whole Mississippi Valley and adjoining regions should be combed for this or closely related species.

There are two specimens (a first-form male and a female) in the collection of the U. S. National Museum, U.S.N.M. No. 62312, from a spring at Imboden, Lawrence County, Ark., collected by Byron C. Marshall. In most respects these specimens are typical *fodiens*; however, the first pleopod of the male shows two rather striking variations. The cephalic surface of the appendage is more convex than it is in typical specimens, and there is a distinct angular prominence on the cephalomesial surface of the appendage just cephaloproximad of the base of the "funnel." The central projection also shows a slight variation from that of typical *fodiens*. Whether these peculiarities are individual variations can be determined only after a series of specimens has been collected in this region.

Engle (1926, p. 93) stated that he had seen a number of specimens of *C. argillicola* from ponds near the State fair grounds, Lincoln, Lancaster County, Nebr. This locality should be confirmed.

It should be noted that in the list of synonymy above, the reference to Lyle, 1938, is preceded by a question. Since he merely lists *Cambarus argillicola* (= *C. fodiens*) from Mississippi, I do not know whether he is referring to the Faxon record (in which case it would fall into the synonymy of *C. byersi*) or whether he actually has additional specimens. In either case (unless his specimens came from the northeastern part of the State, and should prove to be typical *fodiens*) I do not believe this record should be accepted without further confirmation.

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REPORT ON THE PYCNOGONIDA COLLECTED BY THE  
ALBATROSS IN JAPANESE WATERS IN 1900 AND 1906

By JOEL W. HEDGPETH

IN THE 42 years since the *Albatross* investigated Japanese home waters, no extensive report on the Pycnogonida of Japan or of the northwestern Pacific has appeared, with the single exception of Losina-Losinsky's paper (1933) on collections made by various Russian expeditions in the Bering, Okhotsk, and Japanese Seas. Hence, in spite of their age, the collections of the *Albatross* provide the occasion for the first major systematic report on Japanese pycnogonids, or at least of those species occurring in offshore waters, as the bulk of the collections were made by dredging.

The littoral species have evidently been extensively collected by Japanese workers, but with the exception of some short papers by Ohshima relatively little systematic work has been published on the littoral species of the Japanese coasts. The *Albatross* collections shed little light on the littoral fauna, although two previously unreported species were collected by shore parties at Hakodate and on Shimushiru. Other littoral species collected by later visitors to Japan have been included in this collection. Undoubtedly the Japanese have also undertaken expeditions in their home waters, but no reports of pycnogonids collected have come to notice, and it has remained for this long-delayed study of collections made more than 40 years ago to reveal the rich character of the fauna occurring in moderate depths around the Japanese islands.

It has long been known that the genus *Ascorhynchus* is extraordinarily well represented in Japanese waters, with 6 well-established



species identified from the region. Several other genera are equally well represented in the *Albatross* collections, which include 7 species of *Colossendeis* and 4 species of *Pallenopsis*. Two genera that might be expected to have larger representations, *Anoplodactylus* and *Achelia*, are predominantly littoral, and it is probable that study of existing and future shore collections will reveal several more species of both these genera. There is but one well-established species of *Anoplodactylus*, and there appear to be 2 more species, known from females or immature forms, and there are 7 or 8 species of *Achelia*. There are at least 14 species of this latter genus on the Pacific coast of North America. The genus *Tanystylum* is represented by one previously undescribed species, which is evidently rare, whereas there are two species on the California coast that are common within their known ranges. However, species of *Tanystylum* are very small and may have been overlooked. The dredge collections reveal a bewildering array of species of the topheavy genus *Nymphon*, increasing the number of species known from Japanese waters to 16 or 17, several of which are apparently undescribed. It is with reluctance that I propose 9 new species for this genus, but there seems to be no help for it. *Nymphon striatum*, described from Vladivostok and the western edge of the Japanese Sea, is not represented in the *Albatross* collections, and apparently has a restricted range.

In table 1 the distribution of all species mentioned as occurring in Japanese or adjacent waters (from Kamchatka to Okinawa), including the Sea of Okhotsk, is tabulated. An asterisk indicates those species represented in the *Albatross* and other National Museum collections and considered in the systematic section of this report.

I am indebted to Dr. Waldo L. Schmitt, head curator, Department of Zoology, of the United States National Museum, for the privilege of examining these collections and for help with the literature and many other details, without which it would have been impossible to complete this paper.

#### ZOOGEOGRAPHICAL REMARKS

The general location of the Japanese Archipelago in relation to the physical geography of the North Pacific invites comparison with the eastern coast of North America (cf. Ekman 1935, p. 230 ff., and Sverdrup, Johnson, and Fleming, 1942, pp. 718-723). Like that region, Japan lies between a Boreal Arctic and a tropical zone, and its marine fauna is an intermingling of cold- and warm-water species. Like the eastern coast of North America, it is warmed by a northward flowing current which veers eastward (at lat. 35° N. in the Pacific, instead of 40° N., as in the Atlantic), but unlike that region Japan is completely surrounded by water and is the border of a closed inland sea. Another important difference between the Japanese coast and that of eastern

TABLE 1.—*Distribution of Pycnogonida found in Japanese waters and the North Pacific*

Species	Cosmopolitan deep-water species	East Indies	East coast Japan to 35° N.	West coast Japan, Japanese Sea	East coast, N. of 35°, to Sea of Okhotsk	Bering Sea, Alaska	Arctic-Circumpolar	California	Bathymetric range (North Pacific)
<b>NYMPHONIDAE:</b>									
<i>Nymphon grossipes</i> (O. Fabr.?) (Krøyer).....				×	×	×	×		<i>Fathoms</i> 24-150
<i>longitarse</i> Krøyer*.....				×	×	×	×		52-428
<i>breirostre</i> Hodge.....						×	×		3-37
<i>macrum</i> Wilson.....			?						?
<i>micronyx</i> Sars?.....						×			?
<i>japonicum</i> Ortmann*.....			×	×					34-548
<i>braschnikowi</i> Schimkewitsch*.....					×				52-349
<i>hodgsoni</i> Schimkewitsch*.....				×	×				52-100
<i>striatum</i> Losinsky.....				×					.5-35
<i>elongatum</i> Hilton*.....				×	×	×			72-130
<i>kodanii</i> , new species*.....			×						120-649
<i>micropedes</i> , new species*.....			×						505
<i>benthos</i> , new species*.....			×						622
<i>gunteri</i> , new species*.....					×				266
<i>heterospinum</i> , new species*.....					×				266
<i>dissimilis</i> , new species*.....					×				1, 046
<i>uniunguiculatum</i> Losinsky*.....				×					300-428
<i>albatrossi</i> , new species*.....				×					82-440
<i>ohshimai</i> , new species*.....			×						545-712
<i>nipponense</i> , new species*.....					×				244-712
<b>PALLENIDAE:</b>									
<i>Callipallene amirana</i> (Ohshima).....				×					
<i>dubiosa</i> , new species*.....					×				Shore
<i>Propallene longiceps</i> (Böhm).....			×	×					Surface, shallow
<i>Pallenopsis mollissima</i> (Hoek)*.....		×	×						505-1875
<i>tydemani</i> Loman*.....		×	×						434
<i>virgatus</i> Loman*.....		×	×						34-37
<i>stylirostre</i> , new species*.....			×						500-649
<i>Decachela discata</i> Hilton*.....				×				×	59
<b>PHOXICHILIDIDAE:</b>									
<i>Phorichilidium unguellatum</i> , new species*.....			×	×	×				82-600
<i>horribilis</i> , new species*.....					×				229
<i>Anoplodactylus gestiens</i> (Ortmann)*.....			×						31-68
sp. Ohshima.....				×					Shore
sp.*.....			×						22-514
<i>Halosoma derjugini</i> Losinsky.....				×					2
<i>Pycnosoma stronglylocentroti</i> Losinsky.....				×		×			2-40
<b>AMMOTHEIDAE:</b>									
<i>Achelia echinata</i> Hodge.....				×					Shore
sp. Ohshima.....			×						Shore
sp.*.....					×				Shore
<i>alaskensis</i> (Cole).....					×	×			Shore
<i>pribilofensis</i> (Cole)*.....					×	×			Shore
<i>borealis</i> (Schimkewitsch)*.....					×				174-349
<i>superba</i> (Loman)*.....			×		×				40-73
<i>bituberculata</i> , new species*.....			×						Shore
<i>Ammothella bi-unguiculata</i> (Dohrn).....			×						Shore
<i>profunda</i> , new species*.....			×						624

See footnotes at end of table.

TABLE 1.—*Distribution of Pycnogonida found in Japanese waters and the North Pacific—Continued*

Species	Cosmopolitan deep-water species	East Indies	East coast Japan to 35° N.	West coast Japan, Japanese Sea	East coast N. of 35°, to Sea of Okhotsk	Bering Sea, Alaska	Arctic-Circumpolar	California	Bathymetric range (North Pacific)
<b>AMMOTHEIDAE—Continued</b>									<i>Fathoms</i>
<i>Ascorhynchus auchenicus</i> (Slater)*		×	×						25-100
<i>ramipes</i> (Böhm)*			×	×					50-150
<i>japonicus</i> Ives*			×		×				88-918
<i>cryptopygius</i> Ortmann			×						60-150
<i>glabroides</i> Ortmann*				×					40-139
<i>glaberrimus</i> Schimkewitsch*				×					?
<i>Nymphonella tapetis</i> Ohshima				×					Shore
<i>Nymphopsis muscosa</i> Loman		×							20-50
<i>Cilunculus armatus</i> (Böhm)*			×		×				36-349
<i>Lecythorhynchus hilgendorfi</i> (Böhm)*			×	×	×				Shore-37
<i>marginatus</i> Cole				×				×	Shore
sp.*				×					34-37
<i>Endeis mollis</i> (Carpenter)			×						Shore
<b>TANYSTYLIDAE:</b>									
<i>Tanystylum anthomasthi</i> , new species					×				
<b>COLOSSENDEIDAE:</b>									
<i>Colossendeis angusta</i> Sars*	×		×		×				266-624
<i>colossea</i> Wilson*	×	×	×						662-905
<i>macerrima</i> Wilson*	×	×	×						624
<i>japonica</i> Hoek*			×	×					391-875
<i>dofleini</i> Loman*			×		×				229-426
<i>chitinosa</i> Hilton*			×	×		×			31-428
<i>nasuta</i> , new species*				×					391
<b>PYCNOGONIDAE:</b>									
<i>Pycnogonum tenue</i> Slater*			×	×					34-152
<i>stearnsi</i> Ives					×	×		×	Shore
<i>ungellatum</i> Loman*			×						229
<i>benokianum</i> Ohshima			×						Shore
<i>buticulosum</i> , new species*					×				Shore

\*Species represented in the *Albatross* and other U. S. National Museum collections.

▪ Surface tow records.

North America is the rugged, indented character of the former. Such a coast is favorable to a greater variety of littoral species and it is probable that there may actually be twice as many littoral species in this region as are now recognized.

Because there is no adequate channel opening into the Pacific at the north to permit the exchange of water between it and the Pacific, the Japanese Sea is virtually a closed system, based on the diversion of the warm southern current south of Kyushu, which turns upon itself in the northern reaches of the Japanese Sea and flows southward along the Siberian coast as a cool current. Like other similarly enclosed seas, the Japanese Sea has a fauna with endemic species as well as forms which have migrated through the channels into it. North of the Sea

of Japan lies the Sea of Okhotsk, separated from the Pacific by the picket fence of the Kurile chain, with a fauna even more derivative than that of the Sea of Japan. Unfortunately, these interesting regions are still inadequately known, and much of the work that has been done has been published in Russian and Japanese, and many papers are inaccessible to American workers.

The meeting ground of tropical and Boreal Arctic species occurs on the eastern coast of Japan at about latitude  $35^{\circ}$  N., where the warm water Kuroshio turns eastward and the cold Oyashio from Kamchatka and the Kuriles reaches its southern limit. As might be expected, this hydrographic phenomenon is reflected in the limitation of East Indian species to regions south of  $35^{\circ}$  and the restriction of most Boreal Arctic species to the north of that latitude. The most conspicuous example of this is to be found in the genus *Pallenopsis*, a predominantly warm-water genus. Four species are known in Japanese waters. Three of these, *Pallenopsis mollissima*, *tydemani*, and *virgatus*, occur in the East Indies, and the fourth, *P. stylirostre*, is known only from Japanese waters. None of them have been collected north of  $35^{\circ}$ , and it is probable that *P. stylirostre* will be found in more southern waters. It should be noted, however, that it appears more common for Boreal Arctic species to work south into slightly warmer regions than it is for tropical species to work north, a situation also apparent on the eastern coast of North America, where *Nymphon grossipes* and *Pycnogonum littorale* are found south of Cape Cod, but *Endeis spinosa* and *Anoplodactylus lentus* are unknown north of that dividing point.

In spite of the exposed position of the eastern coast of Japan, there appear to be relatively few of those widely distributed species that are known to occur throughout most of the northern oceans. Only *Nymphon longitarse* and probably *N. grossipes*, of the Boreal Arctic species, occur in Japanese waters proper, i. e., near the shore between latitude  $30^{\circ}$  N. and  $45^{\circ}$  N., and are most often reported from the Japanese Sea rather than from the outer coast. A few of the endemic species, notably *Ascorhynchus japonicus* and *Cilunculus armatus*, are found along the shore both north and south of  $35^{\circ}$ , but on the whole species do not cross this boundary, if the collections at hand can be assumed to reflect the actual distribution of pycnogonids in Japanese waters.

Three species are common to Japanese waters and the coast of California: *Decachela discata*, *Lecythorhynchus marginatus*, and *Pycnogonum stearnsi*. Of these species, *Lecythorhynchus marginatus* is reported from the Sea of Okhotsk and *Pycnogonum stearnsi* has been identified from the northern Kuriles. Hence only *Decachela discata*, from station 4987, off the western coast of Hokkaido near latitude  $43^{\circ}$  N., can be considered to occur near Japan proper. A fourth

species known from both the Japanese and California coasts, *Ammothella bi-unguiculata*, is also known from Naples, Hawaii, and Western Australia, and it appears to be that *rara avis* among the Pycnogonida, a cosmopolitan littoral species. This species is obviously a warm-water form, for on the California coast it does not occur north of Point Concepcion, and in Japan it has not been recorded north of latitude 35°. Still another species, *Achelia echinata*, may be cosmopolitan, but it will be necessary to examine comparative material from the various parts of the world in which forms ascribed to this species have been identified before it is possible to confirm this distribution. *Achelia echinata*, or its varieties, has been identified from China (Kiaochow), Japan, Alaska, San Francisco Bay, Europe (Norway, France, England, and Italy) and some authors have suggested that the New England *Achelia spinosa* is also synonymous with this species. As a rule, however, species common to both sides of the Pacific are cold-water forms, which are apparently dispersed from the north (fig. 18).

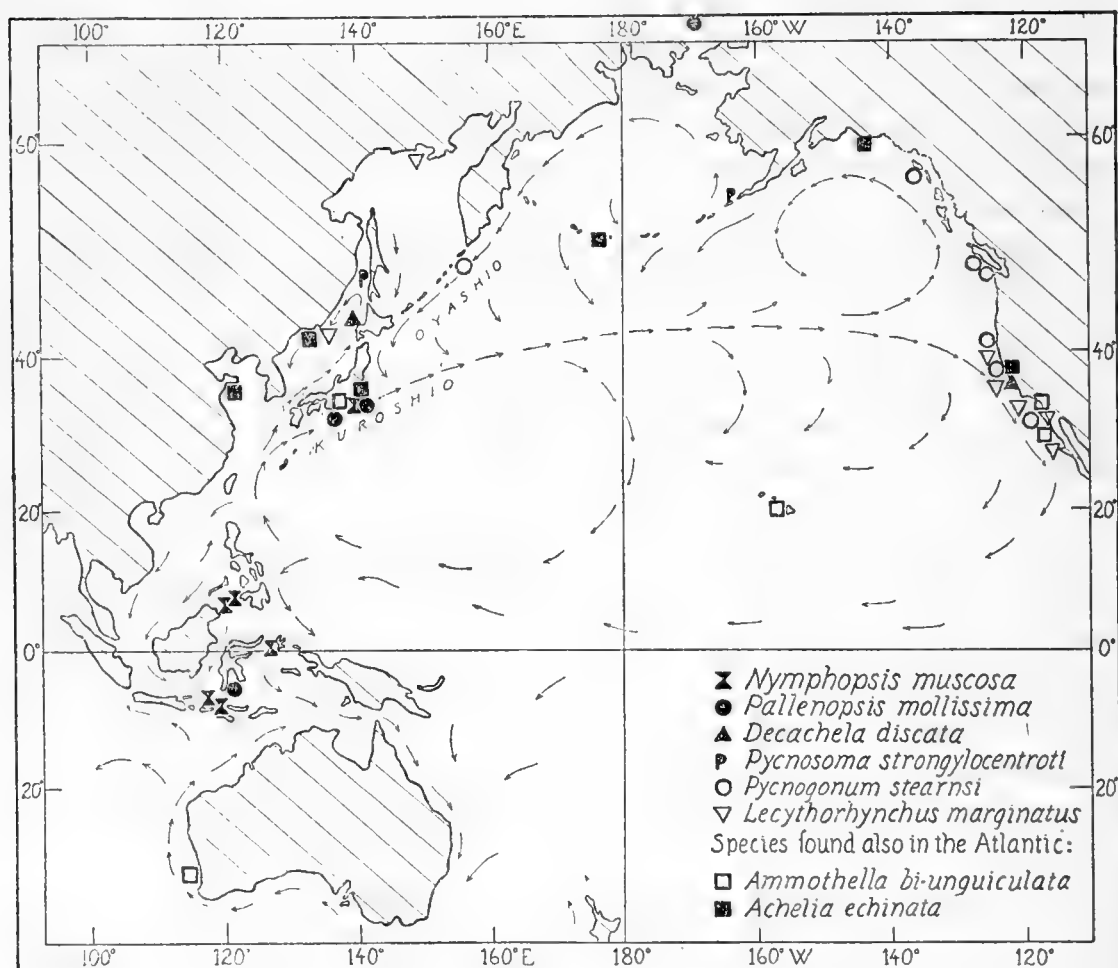


FIGURE 18.—Distribution of various species of pycnogonids in the North Pacific (compiled from various sources).

Evidently the Kuroshio has less effect on the distribution of these animals than the Gulf Stream has in the North Atlantic, and several

East Indian genera found in Japanese waters, such as *Pallenopsis* and *Ascorhynchus*, are rarely reported from California waters. This difference in the distributional effect of the Pacific and Atlantic currents is due primarily to the absence of large rafts of sargassum in the Pacific, which provide a convenient agency for the distribution of small forms in the North Atlantic (Hedgpeth, 1948, p. 170). This is emphasized by the fact that there are no species of *Endeis* or *Anoplodactylus* common to both shores of the North Pacific, as is the case in the North Atlantic, although there are several species that have been collected in tow nets in Japanese waters (Ohshima, 1933c), and which might be expected to have a wider distribution because of this pelagic habit.

There appears to be a characteristic pycnogonid fauna in the Bering Sea, including a northern species of *Pallenopsis* not known elsewhere, one or two species of *Pseudopallene*, and several endemic Nymphons. Some of the Nymphons and Achelias from the Bering Sea are found also along the northern Japanese coast and probably in the Japanese Sea, and it seems likely that they represent dispersals from this cold water area via the Oyashio. The interesting *Pycnosoma strongylocentroti* is probably such a species, since it has been found in the Gulf of Tatar and off Unalaska (the specimen from the latter locality was described by Hilton, 1942c, p. 40, under the name *Pigrogromitus robustus*).

Although these generalizations are based solely on the distribution of pycnogonids, they confirm the character of the Japanese marine fauna as outlined by Ekman (1935, pp. 39-43). His conclusion that the North Pacific littoral fauna (ibid., p. 231) is six to eight times richer than the North Atlantic holds true (although in lesser degree) for the pycnogonids, as it does for the decapods, sea stars, and fishes on which it was based. All the genera containing littoral species in the North Atlantic are represented in the North Pacific, several of them with many more species than in the Atlantic, and in addition there are at least three genera, *Nymphonella*, *Decachela*, and *Lecythorhynchus*, endemic to the North Pacific. Indeed, there is but one authentic endemic genus in the North Atlantic, *Paranymphon*, and its only species is a deep-water form. It must be understood that these remarks do not hold true if the Caribbean region is included in the North Atlantic, for insofar as present knowledge of the pycnogonid fauna of comparable regions is concerned, the Caribbean appears to be somewhat richer than the East Indies in number of genera and species. These remarks, then, apply to the North Atlantic north of Florida and Cape Verde and the Pacific from Japan northward on the west and the California coast on the east.

Recently Gislén (1943, 1944) has published detailed comparisons of the coasts of California and Japan at comparable latitudes. The most



conspicuous difference between the littoral regions is the warmer summer of Japan, accompanied by a tidal exposure occurring at a more unfavorable time of day. The cooler, overcast summers of the California coast offer less severe conditions of exposure to many marine animals, although the greater wave shock of the California coast confines many species to more sheltered locations. This combination of factors is evidently more favorable to littoral or intertidal pycnogonids than are the circumstances prevailing on the Japanese coasts, to judge from the number of species known at present.

This is in substantial agreement with Gislén's summary statement (1944, p. 81) that "on the whole, however, shorewater life has much better possibilities in California than in Japan," although it is more stenothermic on the California coast. Since it appears that most pycnogonids are stenothermic, it is not surprising that there are so many more intertidal or shallow water-forms known on the California coast, although there is, according to Gislén, a greater number of species on the Japanese coast in certain other groups.

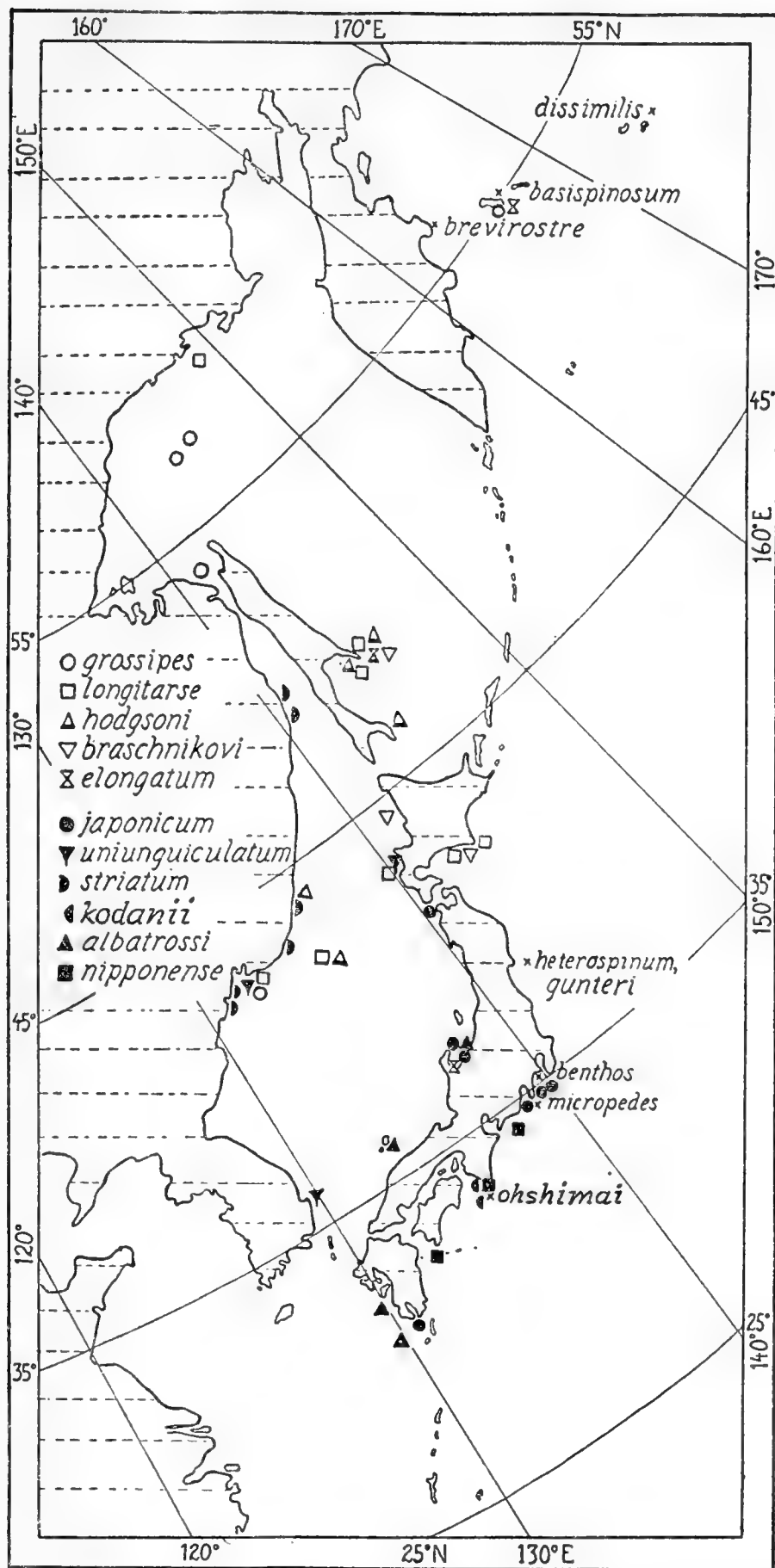
#### THE GENUS NYMPHON

A much better view of the distribution of pycnogonids in the regions under consideration can be had from an examination of the genus *Nymphon*, which comprises nearly 80 percent of the collections made by the *Albatross* and perhaps about 30 percent of the species occurring in the North Pacific. Although a few of the identifications, such as *Nymphon micronyx* from Africa Cape, Kamchatka, and *N. macrum* from Sagami Bay, may be open to question, the general distribution picture, as illustrated in figure 19, can be relied upon. It is possible that the species identified by Ohshima (1936) as *Nymphon macrum* may actually be a specimen of *Nymphon japonicum*, and it seems best to ignore this identification until it is supported by more material or adequate figures.

There are, then, at least 15 species of *Nymphon* present in Japanese and adjacent waters. Some of these are comparatively abundant, and none of them may be rare, although several are so far known only from single specimens. No other genus is so abundantly represented, insofar as actual numbers of specimens (or "species-mass") is concerned. This is in sharp contrast to the Atlantic coast of North America, where such species as *Tanystylum orbiculare* and *Anoplo-dactylus lentus* are often collected in lots of 50 or more. Of course, it is possible that some littoral species are as abundant on the Japanese coast, but on the whole the picture seems to be that of widely distributed species in small numbers, except for the genus *Nymphon*.

As can be seen from the distribution map (fig. 19), the Japanese Sea derives most of its species from cold-water regions, but at least




 FIGURE 19.—Distribution of species of *Nymphon* in the Northwestern Pacific.

two, *Nymphon nipponense* and *japonicum*, have apparently found their way in from the south. Migrations from the north are represented by such species as *grossipes*, *longitarse*, and *hodgsoni*. Two species, *uniunguiculatum* and *striatum*, are apparently endemic. Some of the species found off southern Japan (along the east coast south of lat. 35° N.), such as *japonicum*, *albatrossi*, and *nipponense*, may also occur in the Philippines or East Indies, although no tropical species of *Nymphon* is represented in collections so far reported upon from Japanese waters.

An interesting feature of the species of *Nymphon* from Japanese waters is the relatively high percentage of uniunguiculate forms. Of the 15 species certainly occurring in Japanese waters, four are without auxiliary claws, and there are at least five such species in the North Pacific. This is in sharp contrast to the North Atlantic, in which there are no known species, except the somewhat anomalous *Boreonymphon robustum*, without auxiliary claws. Another interesting

TABLE 2.—Ovigeral spines of various North Pacific species of *Nymphon*

Species	Fine-toothed spines	Coarse-toothed spines (B: coarse basal spines)	North of 35°	South of 35°	East of 180°	West of 180°
WITH AUXILIARY CLAWS						
<i>grossipes</i> .....	×	B	×	-----	×	×
<i>longitarse</i> .....	×	B	×	-----	×	×
<i>brevirostre</i> .....	×	B	×	-----	×	×
<i>macrum</i> .....	×	-----	-----	?	?	-----
<i>micronyx</i> .....	×	B	×	-----	×	-----
<i>japonicum</i> .....	-----	×	-----	×	×	-----
<i>braschnikovi</i> .....	-----	×	×	-----	×	-----
<i>hodgsoni</i> .....	-----	×	×	-----	×	-----
<i>pixellae</i> .....	×	B	×	-----	-----	×
<i>striatum</i> .....	×	-----	-----	-----	×	-----
<i>molum</i> .....	-----	×	×	-----	-----	×
<i>variatum</i> .....	-----	-----	×	-----	-----	×
<i>basispinosum</i> .....	×	-----	×	-----	×	-----
<i>elongatum</i> .....	×	B	×	-----	×	×
<i>microscotusum</i> .....	×	-----	×	-----	×	-----
<i>duospinum</i> .....	×	-----	×	-----	-----	×
<i>orientale</i> .....	-----	×	-----	×	×	-----
<i>micropedes</i> .....	-----	×	-----	×	×	-----
<i>benthos</i> .....	-----	×	-----	×	×	-----
<i>gunteri</i> .....	×	B	×	-----	×	-----
<i>heterospinum</i> .....	×	B	×	-----	×	-----
<i>dissimilis</i> .....	×	-----	-----	×	×	-----
WITHOUT AUXILIARY CLAWS						
<i>uniunguiculatum</i> .....	×	-----	×	×	×	-----
<i>profundum</i> .....	-----	×	×	-----	-----	×
<i>albatrossi</i> .....	×	×	-----	×	×	-----
<i>okshimai</i> .....	-----	×	-----	×	×	-----
<i>nipponense</i> .....	-----	×	-----	×	×	-----

detail is the high number of species in which the compound spines of the oviger bear but two or three pairs of coarse teeth instead of numerous pairs of fine teeth. This characteristic is also of rare occurrence in the North Atlantic, although a Florida species has completely smooth ovigeral spines and a species found on the Grand Banks has spines with two or three pairs of teeth.

This is evidently correlated with temperature, or salinity, or perhaps both, as the tabulation (table 2) indicates a close agreement with the significant latitude of  $35^{\circ}$  in the North Pacific. Such correlation is not evident among North Atlantic species, but it is impossible to tabulate them since the conformation of the ovigeral spines is not described for several west African species. Fage (1942, p. 89) suggests a southern origin for the three west African species of *Nymphon* without auxiliary claws. Unfortunately, he did not describe the denticulation of the ovigeral spines for his two new species of uniunguiculate Nymphons.

#### STATISTICAL COMMENTS ON THE ALBATROSS COLLECTION OF 1906

The *Albatross* occupied 295 stations (4801–5095) in Japanese waters from June to October 1906, at 59 of which pycnogonids were collected. In other words, pycnogonids were collected at about 20 percent of the stations occupied. The depth of these 59 stations ranged from 22 to 918 fathoms, and the average depth was about 325 fathoms. Only two stations, however, were actually near the average depth, and neither can be considered "average" or typical. Most of the stations were in less than 600 fathoms, and only two were in depths of more than 900 fathoms.

More than 375 specimens were taken, representing 11 genera and 36 species, but more than 295 specimens belong to the genus *Nymphon*, and 150 of those are a single species, *Nymphon braschnikowi*. Twenty-six stations are represented by single specimens, and at only 13 stations were more than one species taken. The average number of species per station is 1.6.

Such statistics as these are primarily of value in indicating the relative abundance of various elements in the marine fauna, but comprehensive tabulations are rare except for ecological summaries in connection with limited areas. In such studies the Pycnogonida have usually been overlooked or ignored. However, it would seem that the relative abundance of pycnogonids in the North Pacific is comparable with that in other regions, and the figure of positive hauls in 20 percent of the stations is about what is to be expected in northern waters at least.

Few collecting expeditions are comparable with the 1906 expedition of the *Albatross* in limited area and short time of collecting. Such expeditions as the *Challenger* and *Valdivia* covered vast areas

of the ocean, and the work of the *Albatross* in the North Atlantic was carried out over several years. The most nearly comparable expedition is that of the *Siboga* in the East Indies, which occupied 323 stations between March 1899 and February 1900. Thirty-seven species, representing 17 genera, of pycnogonids were collected at 40 of these stations, and the total number of specimens collected was slightly more than 200. Thus pycnogonids were taken at 12.4 per cent of the stations occupied, and the average number of species per station was slightly less than one. If, however, we discard the phenomenal haul of 80 specimens of *Rhopalorhynchus krøyeri* at station 50, the contrast between hauls in the tropics and in colder waters becomes more apparent. As can be seen from a comparison of tables 3 and 4, there are usually fewer individuals taken in warm water, and the hauls usually contain a greater variety of species. Although less rich in genera and species, the northern fauna is more abundant in individuals, as is true of most elements in the marine fauna.

TABLE 3.—Statistical tabulation of pycnogonids collected by the *Albatross*, 1906

Station	Depth	Number of specimens	Number of species	Station	Depth	Number of specimens	Number of species
	<i>Fathoms</i>				<i>Fathoms</i>		
4780 <sup>1</sup> .....	1,046	1	1	4973.....	600	1	1
4803.....	229	3	3	4974.....	905	1	1
4804.....	229	4	2	4975.....	545-712	6	5
4809.....	207-290	1	1	4977.....	544	3	2
4822.....	130	1	1	4980.....	507	14	3
4826.....	114	26	2	4982.....	390-428	5	3
4829.....	527-548	1	1	4987.....	59	1	1
4833.....	79	1	1	5018.....	100	7	1
4842.....	82	8	2	5020.....	73	4	2
4854.....	335	1	1	5021.....	73	16	4
4891.....	181	1	1	5023.....	75	20	3
4893.....	95-106	1	1	5024.....	67	2	2
4895.....	95	1	1	5025.....	52	8	3
4900.....	139	1	1	5026.....	119	1	1
4908.....	434	1	1	5029.....	440	1	1
4909.....	434	2	1	5032.....	300	5	1
4912.....	391	4	2	5037 <sup>2</sup> .....	175-349	103	4
4913.....	391	1	1	5038 <sup>3</sup> .....	175	50	1
4915.....	427	4	2	5040.....	140-269	1	1
4919.....	440	2	1	5043.....	330	3	1
4933.....	152	1	1	5050.....	266	6	3
4934.....	103-152	20	1	5075.....	22	1	1
4936.....	103	1	1	5078.....	475-514	1	1
4958.....	405	1	1	5079.....	475-505	7	3
4960.....	578	2	1	5080.....	505	2	2
4965.....	191	1	1	5082.....	662	5	2
4967.....	244-253	1	1	5083.....	624	5	3
4969.....	587	3	2	5084.....	918	3	1
4970.....	500-649	1	1	5085.....	622	1	1
4971.....	649	1	1	5094.....	88	2	1

<sup>1</sup> Not in Japanese area.

<sup>2</sup> 100 specimens of *Nymphon braschnikowi*.

<sup>3</sup> *Nymphon braschnikowi*.

TABLE 4.—Statistical tabulation of pycnogonids collected by the Siboga, 1899–1900

Station	Depth	Number of speci- mens	Number of species	Station	Depth	Number of speci- mens	Number of species
	<i>Meters</i>				<i>Meters</i>		
15.....	100	1	1	184.....	36	2	2
45.....	794	4	3	210 a.....	1,944	1	1
49 a.....	69	1	1	213.....	45	2	2
50.....	27–36	80	1	225 e.....	0	1	1
60.....	23	1	1	227.....	2,081	2	1
65 a.....	120–400	2	2	240.....	9–45	+12	1
81.....	34	2	2	258.....	22	1	1
88.....	1,301	2	1	260.....	90	1	1
94.....	450	1	1	271.....	1,788	1	1
99.....	16–23	6	3	273.....	13	3	3
117.....	80	1	1	285.....	34	1	1
122.....	1165–1264	7	4	289.....	112	2	1
129.....	21–31	1	1	294.....	73	1	1
136.....	23	1	1	303.....	36	2	1
154.....	59–83	1	1	310.....	73	6	6
163.....	29	2	2	314.....	694	8	2
167.....	95	1	1	315.....	36	+15	3
172.....	18	6	2	316.....	538	1	1
173.....	567	8	2	318.....	88	2	1
178.....	835	7	2	321.....	82	2	1

SYSTEMATIC DISCUSSION

Family NYMPHONIDAE Wilson, 1878

Genus NYMPHON J. C. Fabricius, 1794

The taxonomic peculiarities of the Japanese species of this genus have already been commented upon and need not be reviewed here. While the bulk of the collections consists of Nymphons, the representation of some species is disappointingly small. There are no specimens of *Nymphon grossipes* or its manifold varieties, and neither *N. brevirostre* nor *N. micronyx*, which have been recognized from the western Pacific by Russian workers, was taken by the *Albatross* near Japan. Future collections may fill in these gaps.

Nine of the species in the collections are described as new; eight of them are from Japanese waters. Future systematic work may reduce some of these to synonymy, but little comparative material has been available, except the types of Hilton's incompletely described species from the Bering Sea and Alaska. I am not the first, nor will I be the last, to lament over the complexities of this genus, and I earnestly hope that revision of its numerous species will not be too long delayed.

KEY TO SPECIES OF NYMPHON FROM THE NORTH PACIFIC

1. Auxiliary claws present.....
 2
- Auxiliary claws absent.....
 22

## KEY TO SPECIES OF NYMPHON FROM THE NORTH PACIFIC—Continued

## A. SPECIES WITH AUXILIARY CLAWS

2. Tarsus as long as or longer than propodus, or more than two-thirds as long... 3  
Tarsus conspicuously shorter, usually about two-thirds as long as, or less than, propodus.....14
3. With prominent or well-defined processes over bases of chelifores..... 4  
Without tubercles or processes over base of chelifores, but bases often roundly swollen..... 5
4. Tubercles large, rounded at apices; spines on propodus not conspicuously large.....*striatum*  
Tubercles small, bluntly pointed; spines on propodus as long as diameter of joint.....*basispinosum* (p. 273)
5. With large spines on sole of propodus..... 6  
Without large spines, or spines not more than half as long as diameter of propodus..... 9
6. Tarsus and propodus subequal, or tarsus slightly longer, but not twice as long as propodus..... 7  
Tarsus twice as long as propodus, large spines on sole usually two, well spaced near middle of joint.....*elongatum* (p. 251)
7. Large spines more than two, not restricted to middle of joint, or, if two, confined to heel..... 8  
With two large spines near middle of propodus.....*gunteri* (p. 257)
8. Two (sometimes three) large spines on heel of propodus..*heterospinum* (p. 259)  
Several spines on sole of propodus, not restricted to heel..*grossipes* (p. 247)
9. Tarsus conspicuously longer (one-and-a-half or twice as long) than propodus.....10  
Tarsus usually equal to propodus, or not conspicuously longer.....11
10. Auxiliary claws about half as long as terminal claw..... *pixellae*  
Auxiliary claws a third as long, or less, than terminal claw. *longitarse* (p. 247)
11. Fourth joint of palpus as long as or not conspicuously shorter than fifth... 12  
Fourth joint of palpus half as long as fifth..... *hodgsoni* (p. 250)
12. Auxiliary claws about half as long as terminal claw..... 13  
Auxiliary claws less than half as long as terminal claw..... *molum* (p. 271)
13. Chelae small, fingers rather short, wedge shaped, with fine teeth. *micronyx*  
Chelae large, fingers long, slender, with numerous large teeth. *japonicum* (p. 249)
14. Origin of oviger well back on neck, immediately anterior to first lateral processes..... 15  
Origin of oviger out on neck just behind base of chelifores. *micropedes* (p. 254)
15. With large spines on sole of propodus..... 16  
Without large spines on sole of propodus..... 20
16. Without stiff bristlelike setae on scape and trunk..... 17  
With stiff bristle or thornlike setae on scape, trunk, and long segments of legs..... 18
17. Spines as long as thickness of propodus or shorter, but not conspicuously longer; fingers of chelae wedge shaped, with close-set teeth..... 19  
Spines of propodus longer than thickness of joint; fingers of chelae slender, with well-spaced teeth..... *dissimilis* (p. 262)
18. Lateral processes well separated by about half their diameter. *microsetosum* (p. 274)  
Lateral processes contiguous, or almost so..... *duospinum* (p. 274)
19. Tarsus about twice as long as thick..... *brevirostre* (p. 248)  
Tarsus usually more than twice as long as thick..... *grossipes* (p. 247)

KEY TO SPECIES OF NYMPHON FROM THE NORTH PACIFIC—Continued

## A. SPECIES WITH AUXILIARY CLAWS—continued

20. Fingers of chelae as long as palm, with 20 or more teeth on the dactylus--20  
Fingers of chelae shorter than palm, 10-12 teeth on the dactylus.  
**benthos** (p. 256)
21. Trunk thickset, relatively heavy; chelae and tibiae not conspicuously setose.  
**braschnikowi** (p. 250)
- Trunk slender, graceful; chelae and tibiae with long, fine setae.  
**kodanii** (p. 252)

### B. SPECIES WITHOUT AUXILIARY CLAWS

- |     |  |                                |
|-----|--|--------------------------------|
| 22. | Tarsus equal to, or longer than propodus.....  | 23                             |
|     | Tarsus shorter than propodus.....  | <b>nipponense</b> (p. 267)     |
| 23. | Fourth joint of palpus equal to, or almost as long as fifth joint.....   | 24                             |
|     | Fourth joint of palpus conspicuously shorter than fifth.....   | 25                             |
| 24. | Teeth of chelae large, widely spaced; eye tubercle an inconspicuous mound<br>or absent altogether, without eyes..... | <b>profundum</b> (p. 270)      |
|     | Teeth of chelae small, close set; eye tubercle prominent, with well-developed<br>eyes.....                           | <b>uniungiculatum</b> (p. 263) |
| 25. | Terminal claw as long as propodus.....   | <b>albatrossi</b> (p. 263)     |
|     | Terminal claw about half as long, or conspicuously shorter than propodus.<br><b>ohshimai</b> (p. 266)                |                                |

### A. SPECIES WITH AUXILIARY CLAWS

**NYMPHON GROSSIPES (O. Fabricius?) Krøyer**

*Nymphon grossipes* FABRICIUS, 1780, p. 41.

*Nymphon grossipes* var. *mixtum* SCHIMKEWITSCH, 1930, pp. 416-421, figs. 107-109.

*Nymphon grossipes* var. *glaciale* SCHIMKEWITSCH, 1930, pp. 421-425, figs. 110-112.

*Nymphon grossipes* LOSINA-LOSINSKY, 1933, pp. 70-71.

?*Nymphon brevirostre* subsp. *glaciale* LOSINA-LOSINSKY, 1933, pp. 69-70.

*Nymphon grossipes mixtum* GILTAY, 1934, p. 50.

*Nymphon turritum* EXLINE, 1936, pp. 416-418, figs. g-k.

*Nymphon mixtum* OHSIMA, 1936, p. 862.—HILTON, 1942a, p. 5.

*Nymphon oculospinum* HILTON, 1942a, p. 5.

*Nymphon nigrognathum* HILTON, 1942a, p. 6.

*Nymphon turritum* HILTON, 1942a, p. 6.

*Nymphon grossipes* HILTON, 1942a, p. 7.

The characters used by Hilton in erecting his new species (pointed eye tubercle and heavy chitinized chelae) are the same remarked upon by Giltay in his specimens from British Columbia, and in view of the wide variation and ubiquitous distribution of this species, I do not believe they can stand as independent species.

Losina-Losinsky's *Nymphon brevirostre* subsp. *glaciale* is evidently part of the *grossipes-mixtum-glaciale* complex and probably should be considered under this species.

**NYMPHON LONGITARSE Krøyer**

*Nymphon longitarse* KRØYER, 1844, p. 112.

*Nymphon longitarse* var. *brevicollis* LOSINA-LOSINSKY, 1929, pp. 540-541, fig. 2, a-g.

*Nymphon longitarse* SCHIMKEWITSCH, 1930, pp. 434-441, figs. 118-120.



*Nymphon longitarse* var. *brevicollis* LOSINA-LOSINSKY, 1933, p. 68.

*Nymphon longitarse* HILTON, 1942a, pp. 3-4.—OHSHIMA and KISHIDA, 1947, p. 1006, fig. 2855.

*Collecting records.*—*Albatross* stations 4982 (1 ovigerous male, 1 female); 5020 (1 specimen); 5021 (3 specimens); 5023 (15 specimens, including ovigerous males); 5024 (1 female); 5025 (1 female); 5037 (1 female); 5040 (1 ovigerous male).

A circumpolar, Boreal Arctic species, usually in shallow water. Some of these specimens, notably from stations 5023 and 5024, are somewhat more compact than the others, suggesting Losina-Losinsky's variety *brevicollis*. All the *Albatross* stations are north of 42° (around Hokkaido), while variety *brevicollis* is reported from the vicinity of Vladivostok near 43° N.

#### NYMPHON MACRUM Wilson

*Nymphon macrum* OHSHIMA, 1936, p. 862.

Although Ohshima states that he "observed one specimen in a collection from Sagami Bay," this species is not represented in these collections, and Ohshima's record may be a mistake, or it may be confused with *N. japonicum*. *Nymphon macrum* is not known to be circumpolar, but is found in the North Atlantic as far south as Cape Hatteras and in the Barents Sea.

#### NYMPHON BREVIROSTRE Hodge

*Nymphon brevirostre* HODGE, 1863, p. 464.

*Nymphon gracile* SARS, 1891, pp. 55-58, pl. 5, fig. a-h.

Nec *Nymphon brevirostre* LOSINA-LOSINSKY, 1929, pp. 542-546, fig. 3, a-g.

Non *Nymphon brevirostre* subsp. *glaciale* LOSINA-LOSINSKY, 1933, pp. 69-70.

*Nymphon brevirostre* DERJUGIN et al., 1935, pp. 11-57.—STEPHENSEN, 1936, p. 10.

*Nymphon microcollis* HILTON, 1942a, p. 5.

*Nymphon gracile* HILTON, 1942a, p. 7.

Losina-Losinsky's (1929) proposal to use this name as a group designation for several closely related forms (which are arranged in a bewildering array of varieties, subspecies, and forms) is unfortunate. According to the synonymy by Stephensen this name belongs to the species described and figured by Sars as *Nymphon gracile*, and the taxonomic group proposed by Losina-Losinsky does not include this species at all.

The specimen for which Hilton has proposed the name *microcollis* agrees closely with Sars's figure, and is readily separable from *Nymphon brevitarse*, which Losina-Losinsky reduced to subspecific rank under *N. brevirostre*, and which I suggested (1943a, p. 89) might be the species identified by Hilton as *N. gracile* Leach. These various names have become so confused that it is almost hopeless to be certain of an identification. Thus one of the purposes of the binomial

system has been defeated, and it looks very much as if the taxonomists themselves are the culprits. This confusion is hardly clarified by the elaborate treatment of Derjugin et al., which follows Losina-Losinsky's revisions but also includes *N. brevirostre* auct.

**NYMPHON JAPONICUM** Ortmann

**FIGURE 20**

*Nymphon japonicum* ORTMANN, 1891, pp. 158-159, pl. 24, fig. 1.—LOMAN, 1911, p. 8.—OHSHIMA, 1936, p. 8.

Non *Nymphon japonicum* OHSHIMA and KISHIDA, 1947, p. 1107, fig. 2856.

*Collecting records.*—*Albatross* stations 3698; 3701 (2 females); 3708 (2 specimens); 3730 (1 female); 3734 (2 females); 3750 (1 ovigerous male); 3752 (1 female); 3755 (1 female); 3757 (1 specimen); 4809 (1 female); 4826 (25 specimens); 4829 (1 male); 4833 (1 male); 4934 (20 specimens, including ovigerous males); 4936 (1 female).

Although Ortmann's description and figure are not all that could be desired, there seems to be no other species in the collection that agrees as well with his description as do these specimens and they are therefore referred to *Nymphon japonicum*. This is a large handsome species, apparently restricted to Japanese waters and therefore appropriately named, as is not often the case with geographically

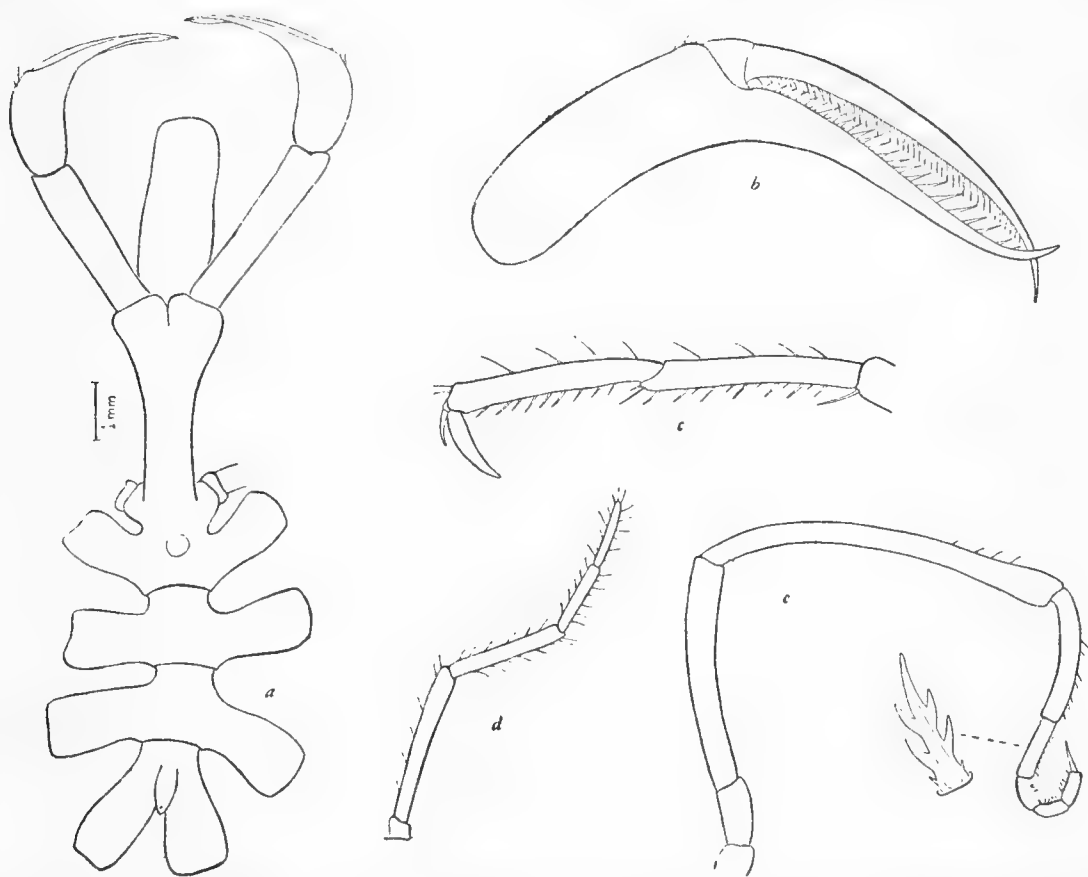


FIGURE 20.—*Nymphon japonicum* Ortmann: a, Trunk; b, chela; c, tarsus; d, palpus; e, oviger.

inspired specific names. The terminal claw is of variable length, in some specimens (in the lot from station 4826) being half as long as the propodus. The figure in Ohshima and Kishida's catalog suggests the species described below as *Nymphon micropedes*, although it is too small for detailed comparison. Their figure indicates a species with a short tarsus, whereas the one clear detail of Ortmann's figure is the subequal condition of the tarsus and propodus, and it also indicates a much longer second coxa than represented in Ortmann's figure and my material.

This species is generally a southern form, but it evidently occurs occasionally as far north as about 40° (station 4809) and is found on both sides of Honshu.

**NYMPHON BRASCHNIKOWI** Schimkewitsch

**FIGURE 21, a-c**

*Nymphon braschnikowi* SCHIMKEWITSCH, 1906, pp. 248-251.

*Nymphon braschnikovi* SCHIMKEWITSCH, 1930, pp. 507-512, figs. 154-160, pl. 9, figs. 1-2.—OHSHIMA, 1936, p. 863.

*Collecting records.*—*Albatross* stations 5024 (1 male); 5025 (6 specimens); 5026 (1 female); 5037 (50 specimens); 5038 (100 specimens).

This is apparently one of the characteristic species of the Sea of Okhotsk, but the two large collections (stations 5037 and 5038) were made off the southern shore of Hokkaido. Its bathymetric range is from 52 to 175, or perhaps 349, fathoms. Several specimens in the larger lots are larvigerous. Most of them are a reddish brown color in alcohol. This species has not been found south of latitude 42° N.

**NYMPHON HODGSONI** Schimikewitsch

**FIGURE 21, d-g**

*Nymphon hodgsoni* SCHIMKEWITSCH, 1913, pp. 244-248, pl. 3a, figs. 15-25; 1930, pp. 512-517, figs. 161-166, pl. 10.—OHSHIMA, 1936, p. 863.—LOSINA-LOSINSKY, 1933, p. 71.

*Collecting records.*—*Albatross* stations 5018 (4 males, 3 females); 5020 (2 females, 1 juvenile); 5021 (10 specimens); 5023 (2 females, 1 juvenile).

This species is similar to *N. braschnikowi* in general appearance, but it never has the short tarsal segment of that species, and it is usually much larger. It occupies about the same bathymetric and geographic range as *N. braschnikowi* and it is possible that the two are actually varieties of each other, although I could find no transitional forms. In *N. hodgsoni* the shape of the chela is not as variable as in *N. braschnikowi*, where it varies from a graceful curve to the blunt *grossipes* type. *Nymphon hodgsoni* has not been collected south of latitude 48° 30' N.

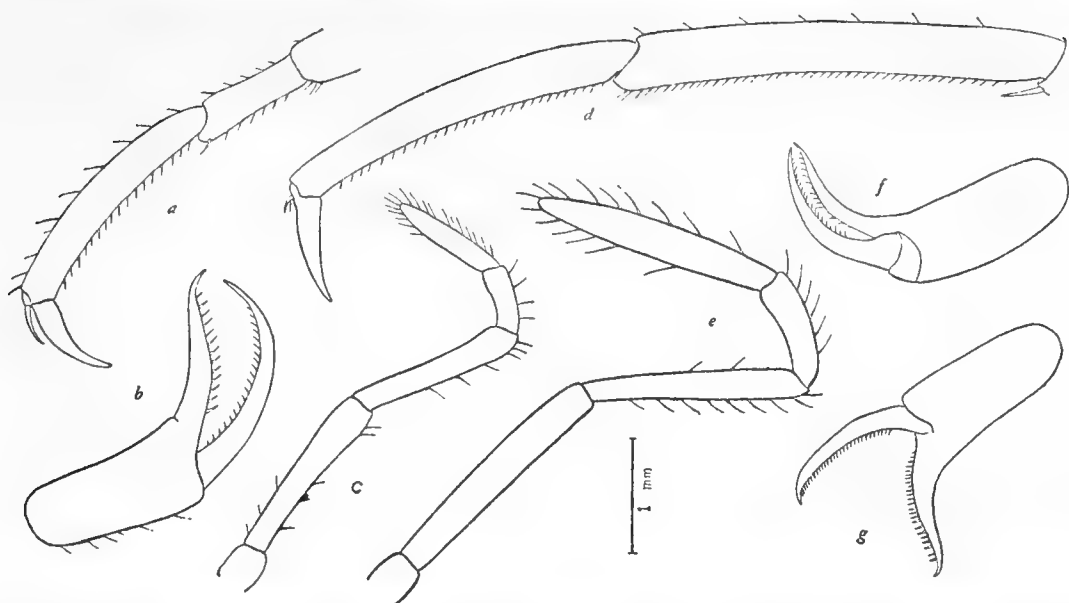


FIGURE 21.—*a-c*, *Nymphon braschnikowi* Schimkewitsch: *a*, Tarsus and propodus; *b*, chela and palpus; *c*, palpus. *d-g*, *N. hodgsoni*, Schimkewitsch: *d*, Tarsus and propodus; *e*, palpus; *f*, *g*, chelae.

#### NYMPHON ELONGATUM Hilton

FIGURE 22; FIGURE 34, *f*

*Nymphon elongatum* HILTON, 1942a, p. 5.

*Collecting records*.—*Albatross* stations 4822 (1 ovigerous male); 5023 (1 ovigerous male, 1 female).

The combination of a long propodus and a small chela is rare in the genus, and constitutes one of the principal characters for identification of this species. In the type specimen I found two large spines on the sole of the propodus, as in one of the other specimens, but in some of the material these are inconspicuous or lacking and on other legs of the same specimens there may be several. The proportions of the palpal segments, conformation of the chela, and shape of the denticulate spines are relatively constant, however. The formulae for the spines on the terminal segments of the ovigers is usually 15:15:15:12::20.

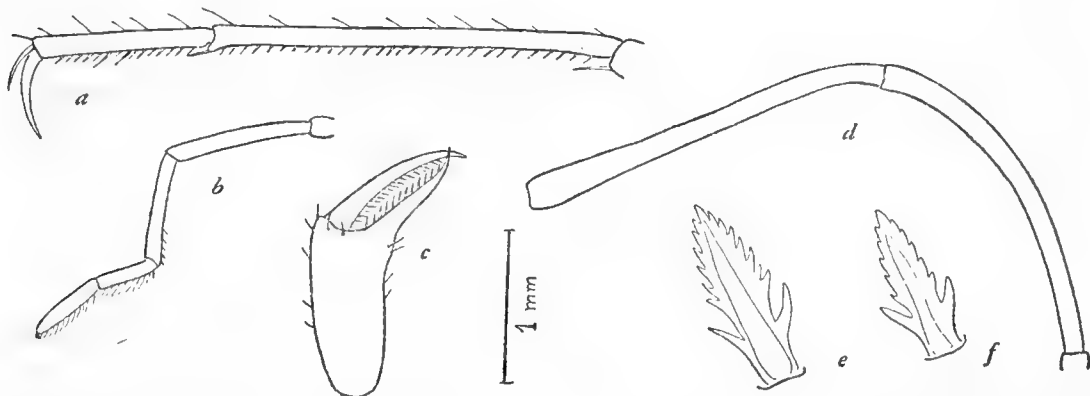


FIGURE 22.—*Nymphon elongatum* Hilton: *a*, Tarsus and propodus; *b*, palpus; *c*, chela; *d*, fourth and fifth joints of oviger; *e*, spine of oviger; *f*, spine from oviger of holotype.

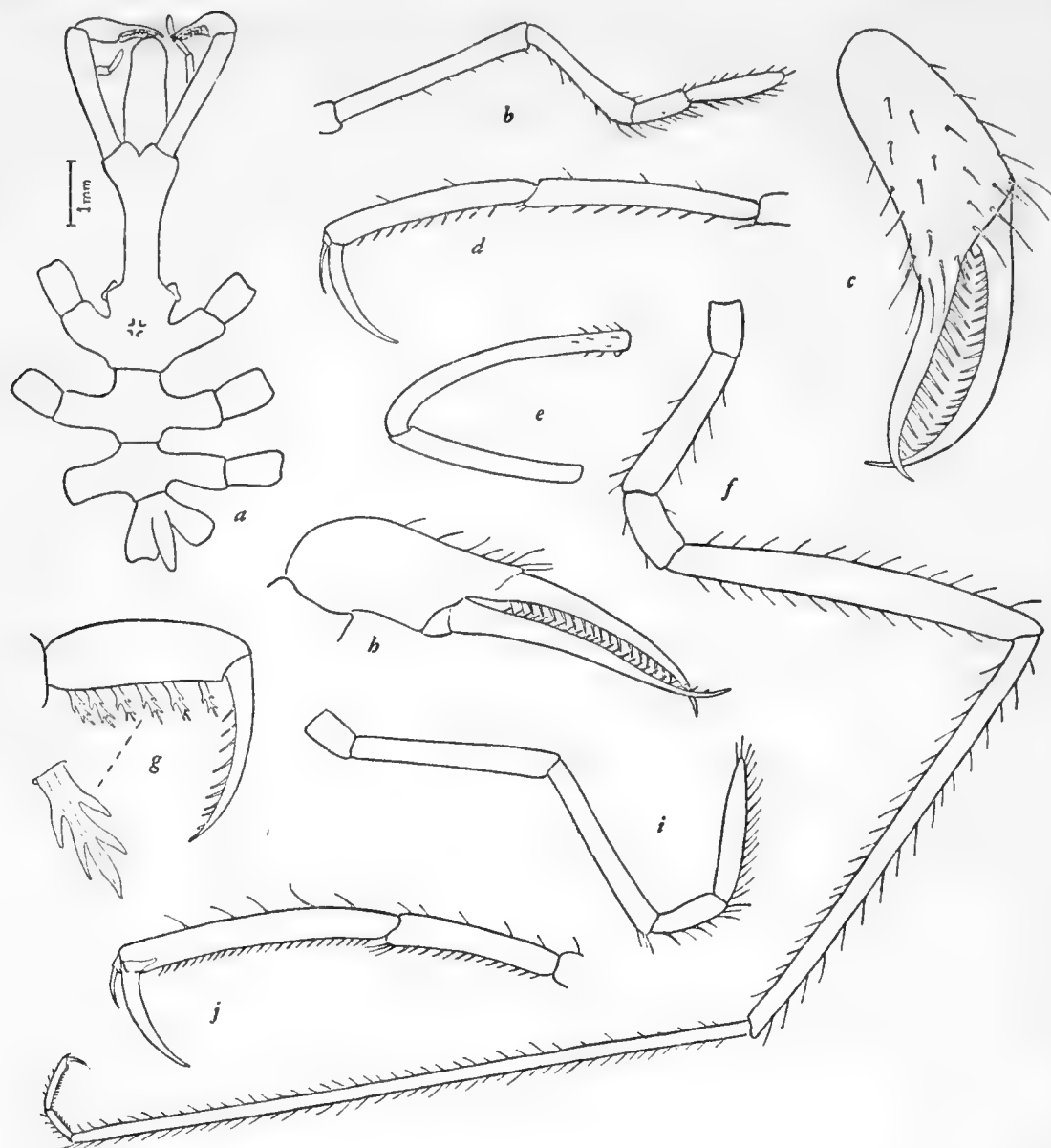


FIGURE 23.—*Nymphon kodanii*, new species: *a*, Dorsal view of holotype; *b*, palp of holotype; *c*, chela of holotype; *d*, tarsus and propodus, holotype; *e*, fourth and fifth joints of oviger, holotype; *f*, third leg, holotype; *g*, terminal joint of oviger, holotype; *h*, chela, paratype; *i*, palp, paratype; *j*, tarsus and propodus, paratype.

This is apparently a species of the central North Pacific. The type specimens are from *Albatross* station 4792, latitude  $54^{\circ}36'15''$  N., longitude  $166^{\circ}57'15''$  E., 72 fathoms, June 14, 1906. *Albatross* station 4822, at latitude  $37^{\circ}08'10''$  N. is the southernmost record for this species.

**NYMPHON KODANII, new species**

**FIGURE 23**

*Types*.—Holotype (male): U.S.N.M. No. 80594, *Albatross* station 4977, latitude  $33^{\circ}23'$  N., longitude  $135^{\circ}37'40''$  E., 544 fathoms,  $38.9^{\circ}$  F., August 31, 1906.

Paratype (male): *Albatross* station 4971, latitude  $33^{\circ}23'30''$  N., longitude  $135^{\circ}34'$  E., 649 fathoms,  $38.1^{\circ}$  F., August 30, 1906.

*Other collecting records.*—*Albatross* stations 3697 (10+ specimens) ; 3698 (6 specimens) ; 4965 (1 female).

*Description.*—Trunk moderately elongate, lateral processes separated by slightly more than their width, body without processes, tubercles, or conspicuous setae. In some specimens the trunk is more closely set. Eye tubercle slightly higher than width at base, bluntly rounded at top, with large well-developed (heavily pigmented) eyes near the apex. Neck about three times as long as wide.

Proboscis as long as neck, cylindrical, and bluntly rounded at tip.

Abdomen papilliform, about as long as last lateral process, directed at an angle of about 50°.

Chelifore about two-thirds the diameter of the neck, as long as proboscis. Chelae fairly heavy, the palm and fingers almost equal in length, fingers slender, curved, crossing at tips and armed with about 17 to 20 to 25 spines on the immovable finger and 20 to 30 on the dactylus. Palm well covered with large setae in some specimens, almost glabrous in others.

Palpus somewhat longer than proboscis, slender, hairy. Fourth joint conspicuously shorter than fifth, the two together slightly longer than the third.

Oviger: Fourth joint not strongly curved, about as long as the fifth, which is straight and weakly clavate. There are a few stiff spines near the base of the fifth joint on the outer side. Compound spines large, coarse, with two pairs of large denticulations. Terminal claw as long as segment, with 8 to 9 well-spaced spines. Formulae of spines: 11:7:7:6::8-9.

Leg: First and third coxae subequal, as long as broad; second coxa somewhat longer than first and third together. Femur straight, about one and a half times as long as the coxae. First tibia not conspicuously longer than femur, second tibia longer than first. The tibiae are slender and sticklike and moderately setose. Tarsus and propodus subequal, with a row of small well-separated spines on ventral surface. Terminal claw large, slender, and well curved, about two-thirds as long as propodus. Auxiliary claws slender, about half as long as terminal claw.

*Measurements* (paratype, male) as follows:

	Mm.	Third leg:	Mm.
Proboscis.....	1.5	First coxa.....	0.75
Trunk.....	5.5	Second coxa.....	2.5
Second lateral process, width..	3.0	Third coxa.....	1.0
Abdomen .....	1.0	Femur .....	5.75
Scape .....	2.0	First tibia.....	7.5
Chela .....	3.25	Second tibia.....	10.8
Palpus .....	4.0	Tarsus.....	1.1
		Propodus.....	2.0
		Terminal claw.....	0.75
		Auxiliary claw .....	0.25

*Remarks.*—This species resembles *Nymphon leptocheles* Sars, from which it differs principally in the structure of the palpus, the fourth joint being much shorter, the longer auxiliary claws, and the coarse toothed spines of the oviger. The specimens exhibit some variation in the length of the tarsal joint, conformation of the palpus, and setose investiture of the trunk and legs, but the ovigers and chelae are comparatively constant (in fig. 23, *c* and *h*, the differences are exaggerated by the angles from which they were drawn), and I suspect that intermediate forms will eventually be collected. This is evidently a warm-water species as all the records are south of 33°.

This species is named for Dr. Masui Kodani, of the University of Rochester, who has been of great help in translating Japanese references.

NYMPHON MICROPEDES, new species

FIGURE 24

*Holotype (male).*—U.S.N.M. No. 80591, *Albatross* station 5080, latitude 34°10'30'' N., 138°40' E., 505 fathoms, 38.7° F., October 19, 1906.

*Description.*—Trunk elongate, slender, lateral processes separated by almost twice their diameter and not much longer than broad. Neck about three times as long as wide, the bases of the ovigers near the anterior end just beyond the origin of the scape. Eye tubercle a low rounded mound, eyes absent.

Proboscis about as long as neck, cylindrical, and squarish at tip.

Abdomen slender, papilliform, about three times as long as wide, directed at an angle of about 45°.

Chelifore: Scape as long as proboscis, moderately robust; chela longer than scape, fingers slightly longer than palm, almost straight but curved and crossing at the tip. Both fingers are armed with numerous close-set spinules.

Palpus longer than proboscis, slender, second and third joints subequal, fourth and fifth subequal but together shorter than the third. Last three joints invested with fine setae.

Oviger rather long and slender, fourth joint slightly curved, with a slight projection at the proximal fourth on the outer side, fifth joint not quite twice as long as fourth, nearly straight, slightly expanded distally. Compound spines of terminal segments large, with usually two pairs of coarse denticulations. Terminal claw as long as joint, with half a dozen well-spaced teeth. Formula: 9 : 6 : 6 : 6 :: 6.

Leg: First and third coxae slightly longer than wide, subequal. Second coxa about twice as long as first and third together. Femur about one-and-a-half times as long as the coxae, weakly arched and with a low projection on the midventral surface which is the site of a pore. First tibia slightly longer than femur, about half as long as



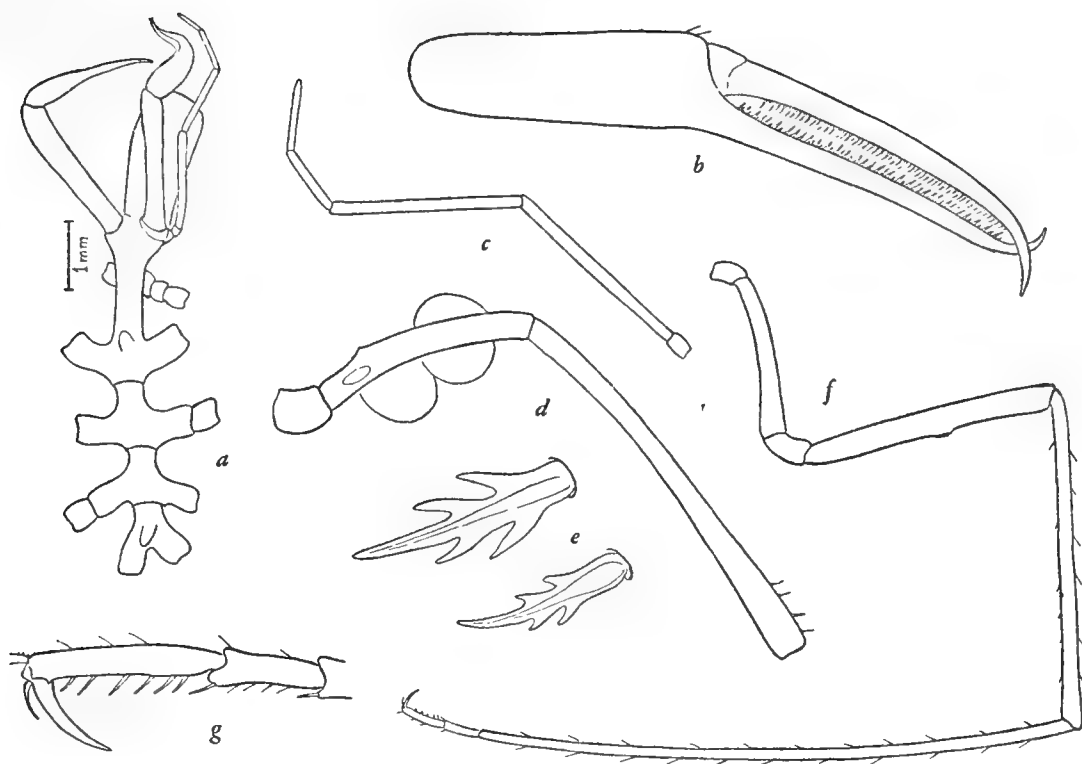


FIGURE 24.—*Nymphon micropedes*, new species: *a*, Dorsolateral view of holotype; *b*, chela; *c*, palpus; *d*, fourth and fifth joints of oviger; *e*, compound spines; *f*, third leg; *g*, tarsus and propodus.

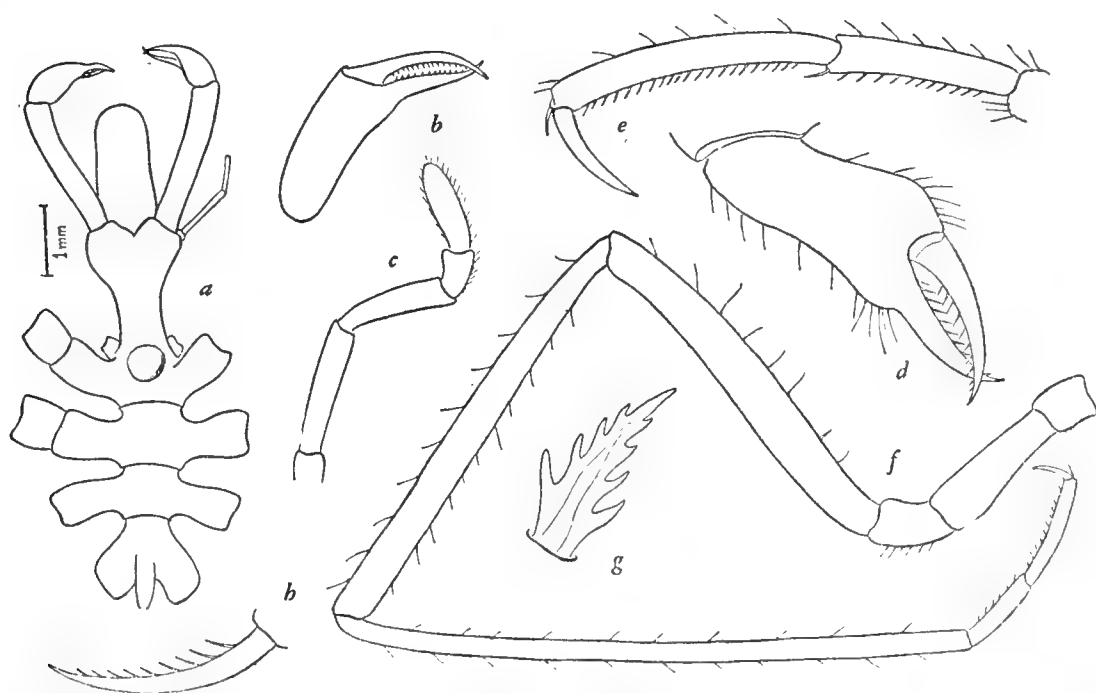


FIGURE 25.—*Nymphon benthos*, new species: *a*, Dorsal view of trunk; *b*, chela; *c*, palpus; *d*, chela, anterior oblique view; *e*, tarsus and propodus; *f*, third leg; *g*, compound spine of oviger; *h*, terminal claw of oviger.

second tibia. Tibiae armed with slender, hairlike setae. Tarsus about two-thirds as long as propodus, with a few moderately large spines on ventral surface. Propodus with half a dozen large spines well spaced along sole. Terminal claw heavy, curved, half as long as propodus; auxiliary claws half as long as terminal claw.

*Measurements.*—As follows:

	Mm.		Mm.
Proboscis.....	2.0	Third leg:	
Trunk.....	4.5	First coxa.....	0.5
Second lateral process, width.....	1.75	Second coxa.....	2.4
Abdomen.....	.25	Third coxa.....	.6
Scape.....	2.0	Femur.....	3.6
Chela.....	2.25	First tibia.....	4.5
Palpus.....	3.75	Second tibia.....	8.75
		Tarsus.....	.4
		Propodus.....	.75
		Terminal claw.....	.5
		Auxiliary claw.....	.1

*Remarks.*—This species is easily distinguished by its combination of very small tarsus and propodus and the large chelae with their slender straight fingers. The locality at which this species was collected is southwest of Sagami Bay. As already remarked above, this seems to be the species identified by Ohshima and Kishida as *N. japonicum*.

#### NYMPHON BENTHOS, new species

#### FIGURE 25

*Holotype (female).*—U.S.N.M. No. 80586, *Albatross* station 5085, latitude 35°06'45" N., 139°19'45" E., 622 fathoms, 37.8° F., October 23, 1906.

*Description.*—Trunk oval in outline, lateral processes separated by about their own diameter. Neck about as long as first two trunk segments, moderately heavy. Eye tubercle erect, between two and three times as high as median diameter, smoothly rounded at top, with well-developed but faintly pigmented eyes near the apex.

Proboscis about as long as neck, cylindrical and rounded at tip, diameter slightly larger than that of neck.

Abdomen as long as last lateral process, papilliform, with a rounded conical tip.

Chelifore: Scape as long as proboscis, diameter about half that of neck, chela small, about two-thirds as long as scape. Fingers about as long as palm, intermediate between the wedge-shaped and long slender type, armed with less than 15 teeth on each finger.

Palpus short, thickset, third joint shorter than second, fourth joint about half as long as fifth, the two together somewhat longer than the third.

Oviger moderately long, the fourth segment shorter than the fifth, both segments relatively straight. Compound spines of terminal joints relatively large, with three or four pairs of coarse denticulations. Formula: 9:6:6:6::9-10.

Leg moderately long, femur and tibial joints armed with short stiff setae. First and third coxae subequal, second coxae about as long as first and third together. Femur about one-and-a-half times as long as coxae, slightly arched. First tibia slightly longer than femur, second tibia half again as long as first. Tarsal joints small, tarsus not quite so long as propodus, ventral surfaces of both joints with a row of well-separated short spines. Terminal claw heavy, less than half as long as propodus. Auxiliary claws very small, less than one-fifth as long as terminal claw.

*Measurements.*—As follows:

	Mm.	Third leg:	Mm.
Proboscis-----	1.8	First coxa-----	0.8
Trunk-----	5.0	Second coxa-----	2.0
Second lateral process, width----	2.75	Third coxa-----	1.0
Abdomen-----	.8	Femur-----	6.0
Scape-----	2.0	First tibia-----	6.5
Chela-----	1.7	Second tibia-----	10.0
Palpus-----	3.6	Tarsus-----	1.25
		Propodus-----	1.9
		Terminal claw-----	.75
		Auxiliary claw-----	.2

*Remarks.*—This species most nearly resembles *N. micronyx* Sars which Schimkewitsch (1930, pp. 476-478) identified from Kamchatka, but I cannot identify this specimen with that species because of the coarse toothed spines of the oviger and the very short auxiliary claws, as well as the considerably greater depth from which it was collected, inasmuch as *N. micronyx* is recorded in depths from 4 to 38 meters. It may be considered a Pacific Ocean form or variety of *Nymphon micronyx* unless Schimkewitsch's specimen is a good *micronyx*; in which case it should be considered a separate species and the circumpolar distribution of *N. micronyx* established on the basis of Schimkewitsch's determination. Derjugin et al. (1935, p. 30) suggest that the Kamchatka specimen is actually *N. brevirostre* auct.

#### NYMPHON GUNTERI, new species

##### FIGURE 26

*Holotype (female).*—U.S.N.M. No. 80588, *Albatross* station 5050, latitude 38°11'30'' N., longitude 142°08' E., 266 fathoms, 37.9° F., October 10, 1906.

*Description.*—Trunk moderately elongate, lateral processes sepa-

rated by about their own diameter. Neck short, relatively thick. Eye tubercle low, bluntly rounded, with well-developed eyes.

Proboscis: About one and a half times as long as neck, slender, cylindrical, and rounded at tip.

Abdomen as long as last lateral processes, papilliform, rounded at tip, erect at an angle of about  $45^\circ$ .

Chelifore: Scape slender, not quite as long as proboscis, slightly arched. Chela about as long as scape, fingers and palm subequal. Fingers moderately heavy, well arched, armed with 10 relatively heavy spinules on the immovable finger and about 15 on the dactylus.

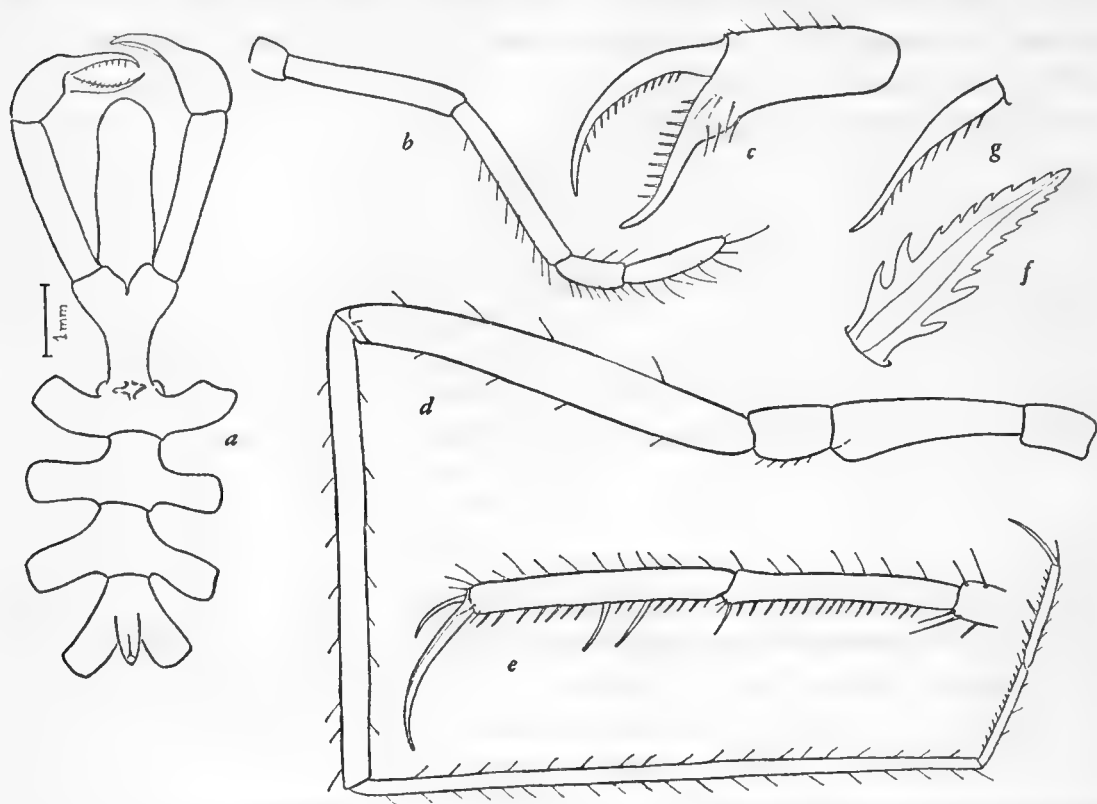


FIGURE 26.—*Nymphon gunteri*, new species: *a*, Dorsal view of holotype; *b*, palpus; *c*, chela; *d*, third leg; *e*, tarsus and propodus; *f*, compound spine of oviger; *g*, terminal claw of oviger.

Palpus slender, the last two joints overreaching the proboscis. Second and third joints subequal, fourth joint little more than half as long as fifth, the two together as long as the third. Terminal joints armed with fine setae.

Oviger: Fourth and fifth joints subequal, relatively straight, the fifth slightly expanded distally. Compound spines of terminal joints moderately broad, with two pairs of basal denticulations, and several pairs of finer, but relatively coarse, denticulations toward the end.

Third leg: First and third coxae about as long as broad, subequal, second coxae not quite so long as first and third together. Femur not markedly shorter than first tibia. Second tibia about one-and-

one-half times as long as first. Tibial joints armed with fine well-spaced setae. Tarsus and propodus subequal, the tarsus with a row of evenly spaced rather long ventral spines, the propodus with a similar row, interrupted near the middle by a pair of large spines, which are slightly longer than the diameter of the propodus. Terminal claw slightly more than half as long as propodus, slightly curved and with a distal knife edge. Auxiliary claw about a third as long as terminal claw.

*Measurements.*—As follows:

	Mm.	Third leg:	Mm.
Proboscis_____	2.75	First coxa_____	1.0
Trunk_____	5.1	Second coxa_____	2.5
Second lateral process, width--	3.0	Third coxa_____	1.25
Abdomen_____	.75	Femur_____	6.0
Scape_____	2.5	First tibia_____	7.0
Chela_____ ca.	2.5	Second tibia_____	9.5
Palpus_____	3.75	Tarsus_____	1.5
		Propodus_____	1.7
		Terminal claw_____	1.0
		Auxiliary claw_____	.4

*Remarks.*—The two large spines of the propodus suggest *Nymphon elongatum* Hilton, but the tarsus is subequal to the propodus in this species instead of considerably longer as in Hilton's species, the compound spines of the oviger are coarsely instead of finely toothed, and the conformation of the chela is noticeably different. The locality from which this species was taken is north of Honshu.

I have named this species for my friend and colleague Dr. Gordon Gunter, who listened to me patiently while this report was in preparation.

#### NYMPHON HETEROSPINUM, new species

##### FIGURE 27

*Holotype* (ovigerous male).—U.S.N.M. No. 80589, *Albatross* station 5050, latitude 38°11'30'' N., 142°08' E., 266 fathoms, 37.9° F., October 10, 1906.

*Description.*—Trunk elongate, lateral processes separated by slightly more than their own diameter. Neck short, thick. Eye tubercle about twice as high as broad, with a sharp forward-directed point, eyes rather small but well pigmented, about halfway between base and tip of tubercle.

Proboscis about twice as long as neck, heavy, cylindrical, but slightly expanded at tip, and broadly rounded.

Abdomen erect, almost vertical, not quite as long as last lateral process.

Chelifore: Scape shorter than proboscis, relatively stout. Chela heavy, as long as scape, palm somewhat longer than fingers, fingers wedge shaped, armed with fine short teeth.

Palpus relatively thick, somewhat longer than proboscis, second and third joints subequal, fourth joint slightly shorter than fifth, the two together a little longer than the third joint, terminal joints armed with fine setae.

Oviger: Fourth joint about half as long as fifth, slightly curved in its distal third, fifth joint straight, moderately clavate. Compound spines small, close set, with fine denticulations and a pair of coarser ones near the base. Terminal claw with about 20 very fine spinules, formula: 18:17:17:15::20.

Third leg: Third coxa slightly longer than first, second almost twice as long as the two together. Femur about twice as long as second coxa, slightly arched. First tibia not conspicuously longer than femur, second tibia half again as long as first. Femur and tibiae sparsely armed with very fine setae. Tarsus and propodus subequal, tarsus with a row of well-spaced short spines along the ventral surface. Propodus moderately arched, with two large spines near the heel and a row of small spines along the rest of the sole. Terminal claw slightly more than half as long as propodus, curved. Auxiliary claw about half as long as terminal claw.

*Measurements.*—As follows:

	Mm.	Third leg:	Mm.
Proboscis -----	2.0	First coxa-----	1.0
Trunk -----	6.0	Second coxa-----	3.5
Second lateral process, width----	3.1	Third coxa-----	1.25
Abdomen -----	.75	Femur -----	7.0
Scape -----	2.0	First tibia-----	7.5
Chela -----	2.25	Second tibia-----	10.5
Palpus -----	3.0	Tarsus -----	1.5
		Propodus -----	1.5
		Terminal claw-----	1.0
		Auxiliary claw-----	.4

*Remarks.*—Although taken at the same station as the preceding species, *N. heterospinum* is markedly different in the structure of the chela, position of the large spines on the propodus, and the finely serrated compound spines of the oviger. Some of these characters suggest *Nymphon grossipes*, but I have not noticed any specimens of this highly variable species in which the large spines of the propodus are restricted to the heel as in this specimen.

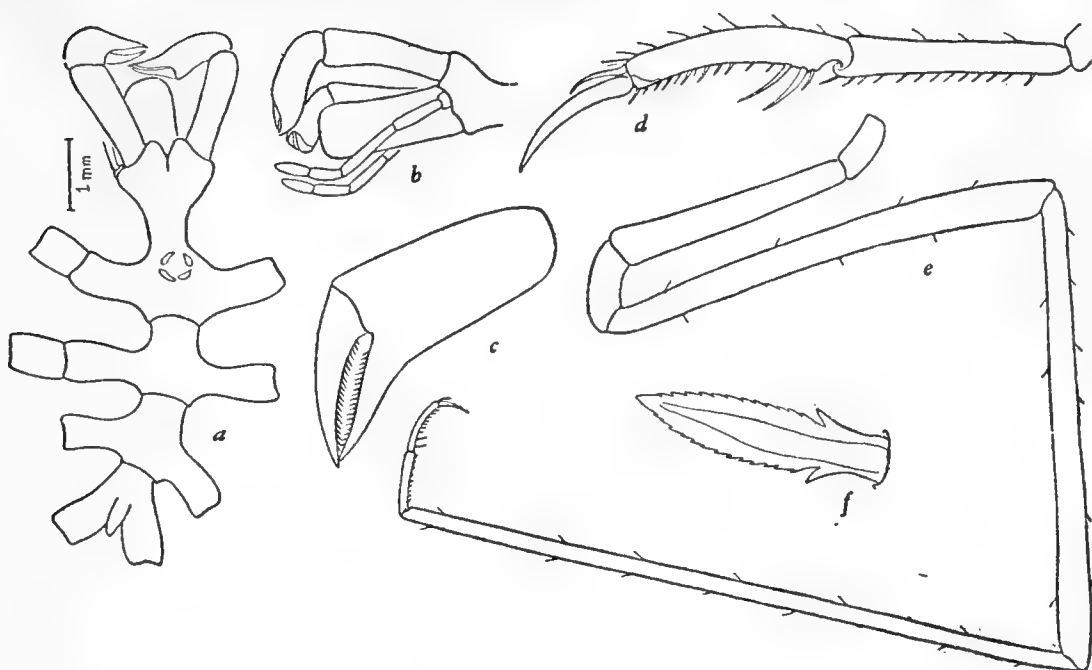


FIGURE 27.—*Nymphon heterospinum*, new species: *a*, Dorsal view of holotype; *b*, lateral view of anterior region; *c*, chela; *d*, tarsus and propodus; *e*, third leg; *f*, terminal spine of oviger.

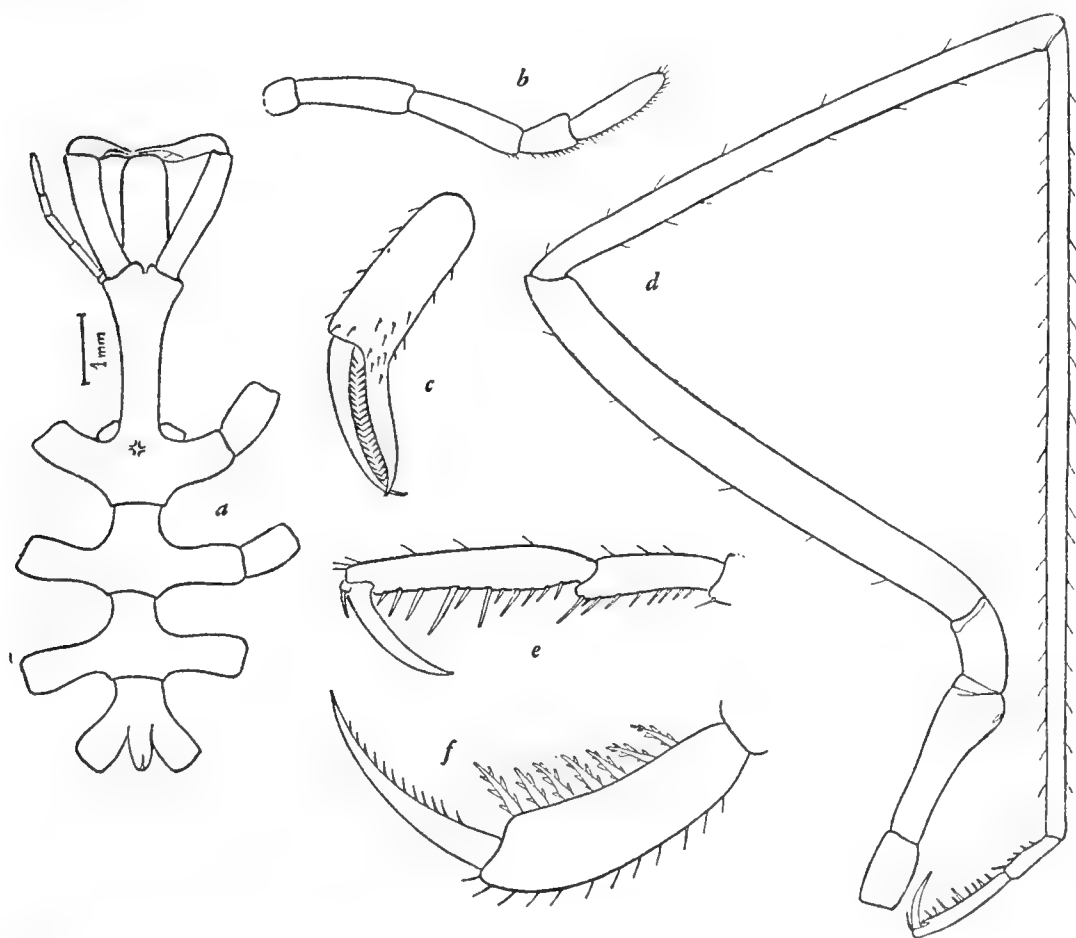


FIGURE 28.—*Nymphon dissimilis*, new species: *a*, Dorsal view of holotype; *b*, palpus; *c*, chela; *d*, third leg; *e*, tarsus and propodus; *f*, terminal joint of oviger.



## NYMPHON DISSIMILIS, new species

## FIGURE 28

*Holotype (female).*—U.S.N.M. No. 80587, *Albatross* station 4780, latitude  $52^{\circ}01'$  N., longitude  $174^{\circ}39'$  E., 1,046 fathoms,  $35.9^{\circ}$  F., June 7, 1906.

*Description.*—Trunk smooth, elongate, narrowly oval in outline, lateral processes separated by one and one-half times their diameter. Neck long, slender. Eye tubercle prominent, narrowly pointed, and with four large eyes.

Proboscis slightly heavier and shorter than neck, cylindrical, and boldly rounded at tip.

Abdomen not quite so long as last lateral process, papilliform, rounded at tip, directed at an angle of about  $40^{\circ}$ .

Chelifore: Scape rather heavy, shorter than proboscis. Chela about as long as scape, palm moderately thick, fingers about as long as palm, slender, moderately curved, with more than 20 well-spaced short spinules on each finger.

Palpus somewhat longer than proboscis, second and third joints subequal, fourth segment half as long as fifth, the fifth alone almost as long as the third.

Oviger: Fourth joint rather heavy, straight, with a large pore near the proximal end, fifth joint about a third again as long, straight, slightly swollen distally. Compound spines coarsely toothed, terminal claw slender, curved, almost as long as terminal joint, with a dozen or more spinules. Spine formula: 10:8:8:7::12.

Third leg: First and third coxae subequal, second coxae as long as first and third together. Femur not quite twice as long as coxae, relatively straight. First tibia slightly longer than femur, second tibia half again as long as first, with an investment of fine setae. Tarsus little more than half as long as propodus, with coarse spines along sole. Propodus with much heavier spines, some of them longer than the diameter of the joint, scattered between shorter spines. Terminal claw heavy, half as long as propodus. Auxiliaries about one-fourth as long as terminal claw.

*Measurements.*—As follows:

	Mm.	Third leg:	Mm.
Proboscis.....	+1.5	First coxa.....	1.0
Trunk.....	6.5	Second coxa.....	2.5
Second lateral process, width....	3.25	Third coxa.....	1.1
Abdomen.....	.6	Femur.....	8.0
Scape.....	2.0	First tibia.....	8.25
Chela.....	2.0	Second tibia.....	11.25
Palpus.....	2.75	Tarsus.....	.8
		Propodus.....	1.6
		Terminal claw.....	.75
		Auxiliary claw.....	.2

*Remarks.*—This species has no salient characters; it is just something that fails to fit in. Except for the rather slender chelae and the coarse compound spines of the oviger it might be mistaken for *grossipes*. The presence of such large eyes suggests that perhaps the specimen was incorrectly labeled, for abyssal species are usually blind. The locality is southeast of Agattu, near the end of the Aleutian Chain.

## B. SPECIES WITHOUT AUXILIARY CLAWS

### NYMPHON UNIUNGUICULATUM Losina-Losinsky

FIGURE 29

*Nymphon uniunguiculatum* LOSINA-LOSINSKY, 1933, pp. 62-64, 78-79.

*Collecting records.*—Albatross stations 4854 (1 female); 4982 (1 female, juvenile).

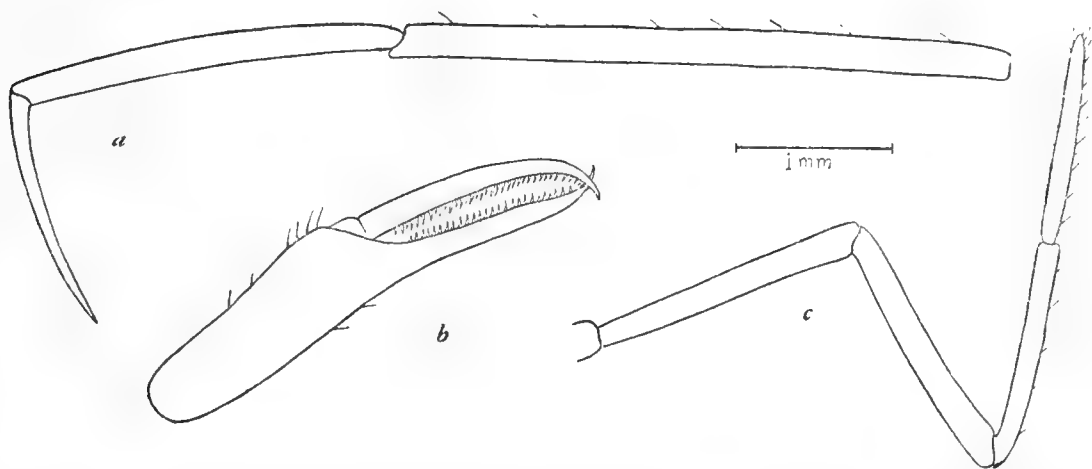


FIGURE 29.—*Nymphon uniunguiculatum* Losina-Losinsky: *a*, Tarsus and propodus; *b*, chela; *c*, palpus.

Previously reported from the vicinity of Peter the Great Bay on the Siberian edge of the Japanese Sea. These records extend the distribution southward to the coast of Korea, and northward to the western shore of Hokkaido. It is apparently restricted to moderately deep water, for Losina-Losinsky's records are from 510-545 and 167-340 meters.

### NYMPHON ALBATROSSI, new species

FIGURE 30

*Types.*—Holotype (ovigerous male): U. S. N. M. No. 80584, *Albatross* station 4826, latitude  $37^{\circ}25'$  N., longitude  $137^{\circ}32'$  E., 114 fathoms,  $42.5^{\circ}$  F., July 21, 1906.

Paratypes (3 females): *Albatross* station 4915, latitude  $31^{\circ}31'$  N., longitude  $129^{\circ}25'30''$  E., 427 fathoms, August 12, 1906.

*Additional collecting records.*—*Albatross* stations 4842 (2 females); 4909 (2 females); 4913 (1 females); 4919 (2 specimens, probably females).

*Description.*—Trunk elongate, lateral processes well separated by from about half to equal their diameter. Integument smooth. Neck of variable length, from three or four times as long as broad to about half that length. Eye tubercle a low, rounded to square-topped knob.

Proboscis as long as or longer than neck, or about three times as long as broad, roughly cylindrical but slightly swollen near middle and tip, largest distally.

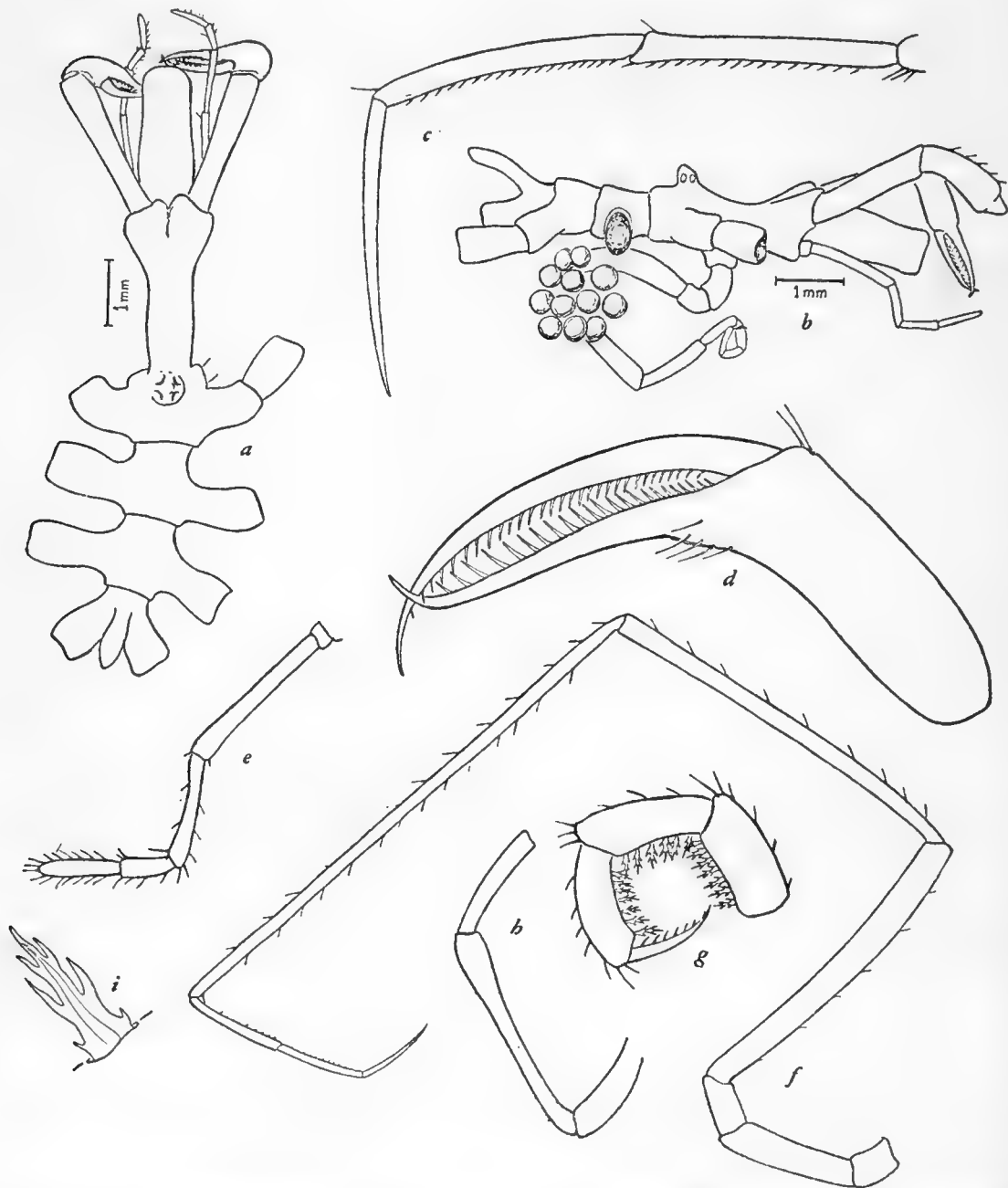


FIGURE 30.—*Nymphon albatrossi*, new species: *a*, Dorsal view, paratype; *b*, lateral view, holotype; *c*, tarsus and propodus; *d*, chela, paratype; *e*, palpus; *f*, third leg, holotype; *g*, terminal joints of oviger; *h*, fourth and fifth joints of oviger.

Abdomen longer than lateral process, slightly curved, tapering in distal half, directed at an angle of  $45^\circ$ .

Chelifore: Scape heavy, about as long as proboscis; chela longer than scape, slender, curved. About 15 to 25 large well-separated teeth on immovable claw and from 16 to 30 teeth on the dactylus.

Palpus slender, straight, with fine setae on the terminal joints. In some specimens the fourth joint is noticeably shorter than the fifth; in others it is almost as long.

Third leg: First and third coxae subequal, from slightly longer than their diameter to almost twice that length. Second coxa about as long as first and third together. Femur slightly arched, slightly shorter than first tibia. Tibiae straight, sticklike, subequal, with a scattering of fine setae. Tarsus and propodus subequal, with a row of well-separated fine spines along the ventral surface. Terminal claw almost straight, as long as propodus. No auxiliary claws.

Oviger: Fourth joint slightly curved; fifth joint almost straight, expanded distally to about twice the median diameter. Compound spines large, with three or four pairs of coarse denticulations. Terminal claw almost as long as terminal joint, with 6 to 12 widely separated spines. There are usually six or seven compound spines on each joint. Formula: 7:7:6:7::7.

*Measurements* (holotype) as follows:

	<i>Mm.</i>	Third leg:	<i>Mm.</i>
Proboscis .....	2.0	First coxa.....	0.75
Trunk .....	7.5	Second coxa .....	2.0
Second lateral process, width....	3.5	Third coxa.....	1.0
Abdomen .....	1.0	Femur .....	5.1
Scape .....	2.1	First tibia.....	6.0
Chela .....	2.5	Second tibia.....	9.0
Palpus .....	4.5	Tarsus .....	1.8
		Propodus .....	1.9
		Terminal claw.....	2.1

*Remarks.*—This species is close to *Nymphon longicoxa* Hoek, from the South Pacific near Auckland, but it differs in the following respects: The terminal claw is much longer, and the male oviger is straighter and lacks the peculiar processes on the dorsum described by Hoek. In many specimens the fourth joint of the palpus is shorter, but the variable length of this joint suggests a close relationship with Hoek's species. There is, however, no variation in the length of the terminal claw, and the propodus is not conspicuously longer than the tarsus as in *N. longicoxa*, nor does *N. albatrossi* have the very long second coxae of that species. It is readily distinguished from *N. unilinguiculatum* by the shorter fourth joint of the palpus, the larger teeth in the chelae, the coarser denticulations of the spines of the oviger, and the much longer terminal claw of the legs. This

appears to be a southern form, occurring approximately between latitude  $30^{\circ}$  and  $36^{\circ}$  N. and longitude  $120^{\circ}$  and  $133^{\circ}$  E., southeast and southwest of Honshu.

**NYMPHON OHSHIMAI, new species**

FIGURE 31

*Holotype (ovigerous male)*.—U.S.N.M. No. 80590, *Albatross* station 4975, latitude  $33^{\circ}21'30''$  N., longitude  $135^{\circ}38'50''$  E., 545–712 fathoms,  $37.5^{\circ}$  F., August 31, 1906.

*Description*.—Trunk relatively short, lateral processes separated by less than their own diameter, forming an oval outline. Neck heavy, about twice as long as broad. Eye tubercle small, about one-and-a-half times as high as broad, rounded at tip and with small eyes, located on the anterior margin of the cephalic segment.

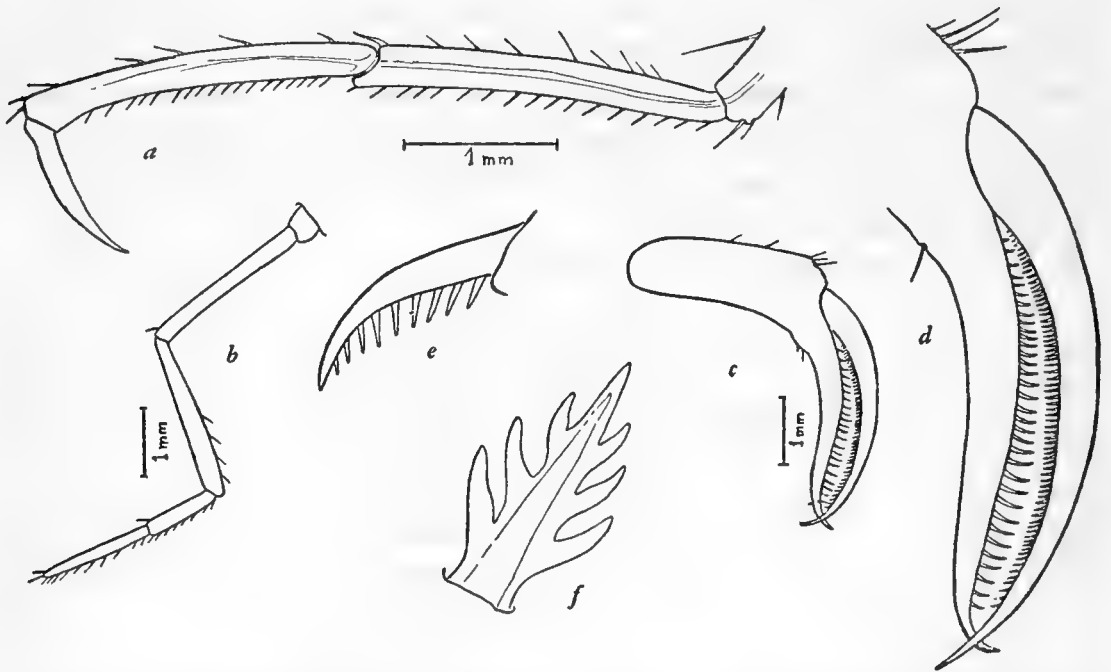


FIGURE 31.—*Nymphon ohshimai*, new species: *a*, Tarsus and propodus; *b*, palpus; *c*, chela; *d*, enlarged detail of chela; *e*, terminal claw of oviger; *f*, compound spine of oviger.

Proboscis thick, not much longer than neck, cylindrical and with a square tip.

Abdomen missing.

Chelifore: Scape about three-fourths the diameter of the neck, longer than the proboscis, slightly arched. Chela long, slender, with curved fingers as long as the palm. There are about 35 large well-separated spinules on the immovable finger, and about 80 short close-set spinules on the dactylus. There is a deep groove between the bases of the chelifores.

Palpus long, slender, second and third joints subequal, fourth somewhat shorter than fifth but not conspicuously so, the fourth and fifth

joints together slightly longer than the third. Terminal joints adorned with fine setae.

Oviger rather short and heavy. Fourth segment shorter than fifth, slightly curved; fifth segment straight, slightly dilate at distal end, but without conspicuous processes or spines. Compound spines of terminal segments large, with two or three pairs of coarse denticulations. Terminal claw large, with 8 or 9 picketlike spines. Formula: 13:11:9:9::9.

Third leg: First and third coxae quadrate, second coxa about two-and-a-half times as long as first and third together. Femur not quite as long as first tibia and slightly more than half as long as second. There are fine setae on the long joints. Tarsus and propodus subequal, with fine well-separated spines along the ventral surface. Terminal claw large, heavy, half to less than half as long as propodus. Auxiliary claws lacking.

*Measurements.*—As follows:

	Mm.	Third leg:	Mm.
Proboscis -----	3.0	First coxa-----	1.5
Trunk-----	9.0	Second coxa-----	5.0
Second lateral process, width----	4.0	Third coxa-----	1.3
Abdomen -----		Femur-----	12.0
Scape-----	4.5	First tibia-----	15.25
Chela (chord)-----	6.5	Second tibia-----	21.5
Palpus-----	7.5	Tarsus-----	2.25
		Propodus-----	2.2
		Terminal claw-----	1.1

*Remarks.*—In some ways this species is intermediate between *N. uniungiculatum* and *N. albatrossi*. It has the large chela of *N. uniungiculatum*, but with many more teeth, and the palpi of the two species are similar, although the fourth joint of *N. ohshimai* is somewhat shorter. However, it is much longer than the comparable joint in *N. albatrossi*. The structure of the compound spines of the oviger is closer to *N. albatrossi* than to *N. uniungiculatum*. *N. ohshimai* appears to be a much larger species than either *N. uniungiculatum* or *N. albatrossi*, to judge from this single male specimen, which is somewhat flabby.

The locality is southeast of Shikoku.

This species is named for Dr. Hiroshi Ohshima, former director of the Amakusa Marine Biological Laboratory, who has made several excellent contributions to the literature on the Pycnogonida.

#### NYMPHON NIPPONENSE, new species

#### FIGURE 32

*Types.*—Holotype (ovigerous male): U.S.N.M. No. 80592, *Albatross* station 4980, latitude 34°09' N., longitude 137°55' E., 507 fathoms, 39.0° F., September 1, 1906.

Paratypes (6 females, 5 males) : Same locality.

*Additional collecting records.*—*Albatross* stations 4960 (2 females) ; 4967 (1 male) ; 4975 (1 male) ; 4977 (1 male, 1 female).

*Description.*—Trunk moderately elongate, lateral processes separated by about their own diameter. Body smooth, without conspicuous spines or tubercles. Eye tubercle slightly higher than broad, bluntly

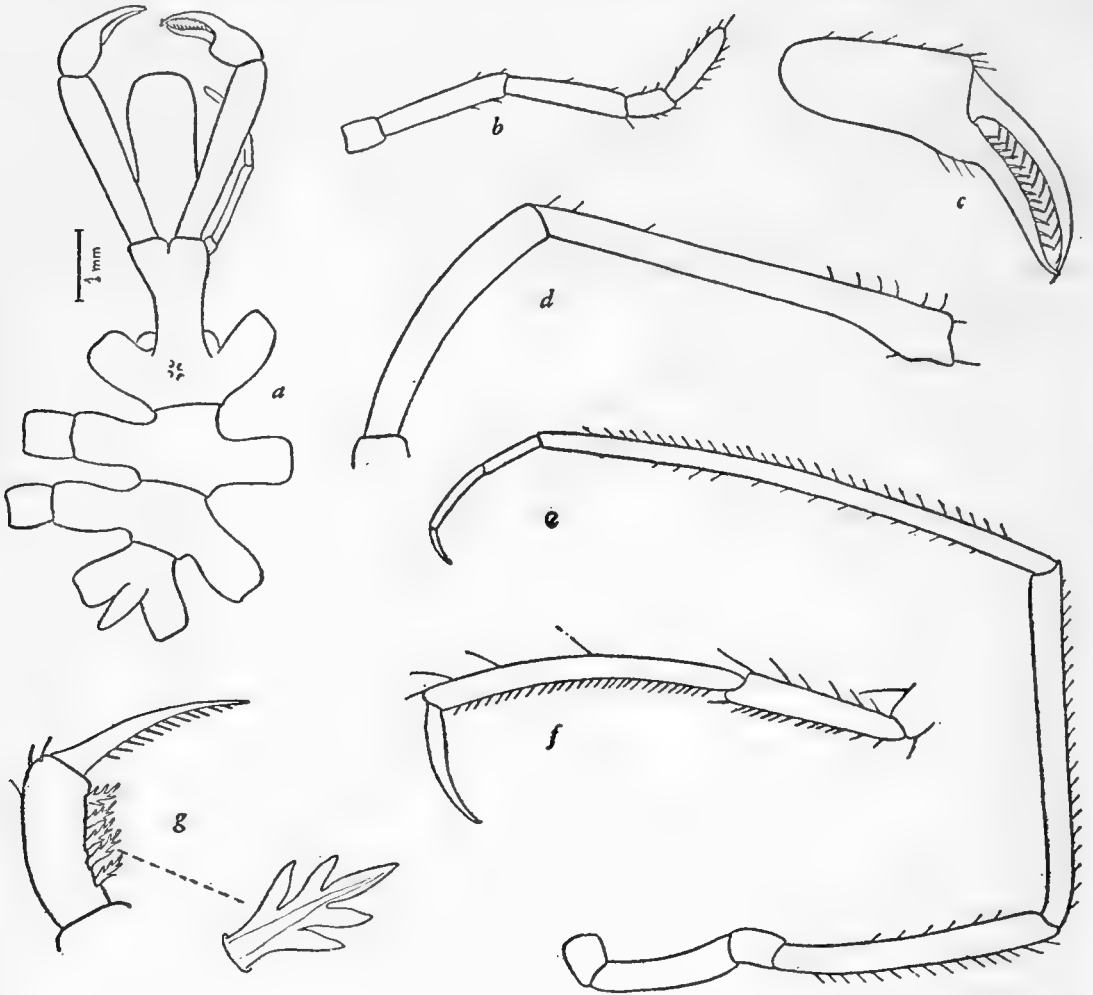


FIGURE 32.—*Nymphon nipponense*, new species: *a*, Dorsal view of holotype; *b*, palp; *c*, chela; *d*, fourth and fifth joints of oviger; *e*, third leg; *f*, tarsus and propodus; *g*, terminal joint of oviger.

rounded and usually tilted slightly backward; eyes large, well developed.

Proboscis slightly longer than neck, cylindrical.

Abdomen short, papilliform, not much longer than last lateral processes.

Chelifore: Scape stout, about as long as proboscis; chelae moderately long, slender, and curved, armed with large, well-separated teeth, 12 to 15 teeth on each finger.



Palpus rather short and thick, the fourth joint about half as long as the fifth.

Oviger: Fourth joint conspicuously shorter than fifth, arcuate but not strongly curved, fifth joint straight, club-shaped in both sexes, but somewhat more angular in the male and with several reversed spines toward the distal end. The compound spines of the oviger are large and coarse, with two or three pairs of large denticulations. Terminal claw somewhat longer than terminal joint, with about a dozen well-separated spinules. Formula of spines on terminal joints usually 11:6:6:5::12.

Third leg fairly robust, with fine setae on femoral and tibial joints. First and third coxae subequal, second coxae about as long as first and third together. Femur straight, shorter than first tibia. Second tibia longer than first. Propodus slightly more than half as long as tarsus, both joints with a row of close-set small spines along ventral surface. Terminal claw moderately heavy, fairly straight, about a third as long as the propodus. No auxiliary claws.

*Measurements.*—As follows:

	<i>Mm.</i>	Third leg:	<i>Mm.</i>
Proboscis -----	2.5	First coxa-----	0.6
Trunk -----	5.1	Second coxa-----	2.0
Second lateral process, width---	3.25	Third coxa-----	.7
Abdomen -----	.8	Femur -----	4.0
Scape -----	2.5	First tibia-----	5.0
Chela -----	2.3	Second tibia-----	7.75
Palpus -----	2.75	Tarsus -----	1.1
		Propodus -----	2.1
		Terminal claw-----	.8

*Remarks.*—This species is separable from the other uniungiculate species from Japanese waters on the basis of the short propodus, the small palpus, and smaller chela with its large, well-separated spinules. The conspicuously straight fifth joint of the oviger also appears to be characteristic. All the material was collected in moderately deep water off the southern coast of Honshu.

#### NOTES ON HILTON'S SPECIES OF NYMPHON

Before it was possible to make final determinations of the material from Japanese waters in this genus, it was necessary to examine the types of the several new species of *Nymphon* from the North Pacific proposed by Hilton (1942a), inasmuch as only brief diagnoses were given. Several of these have already been cited in the foregoing taxonomic discussion, but in order to clarify the status of all of them, brief comments and drawings of diagnostic characters are presented below. Only the material personally examined is cited.

## NYMPHON PROFUNDUM Hilton

## FIGURE 33, a-f

*Nymphon profundum* HILTON, 1942a, p. 3.

*Collecting record*.—Albatross station 4766, latitude 52°38' N., longitude 174°49' W., 1,766 fathoms, May 31, 1906, 1 female, holotype.

This is a uniunguiculate species, differing from those found in Japanese waters in the absence of an eye tubercle, which character it shares with *N. hamatum* Hoek and *N. procerum* Hoek (1881, see also Gordon,

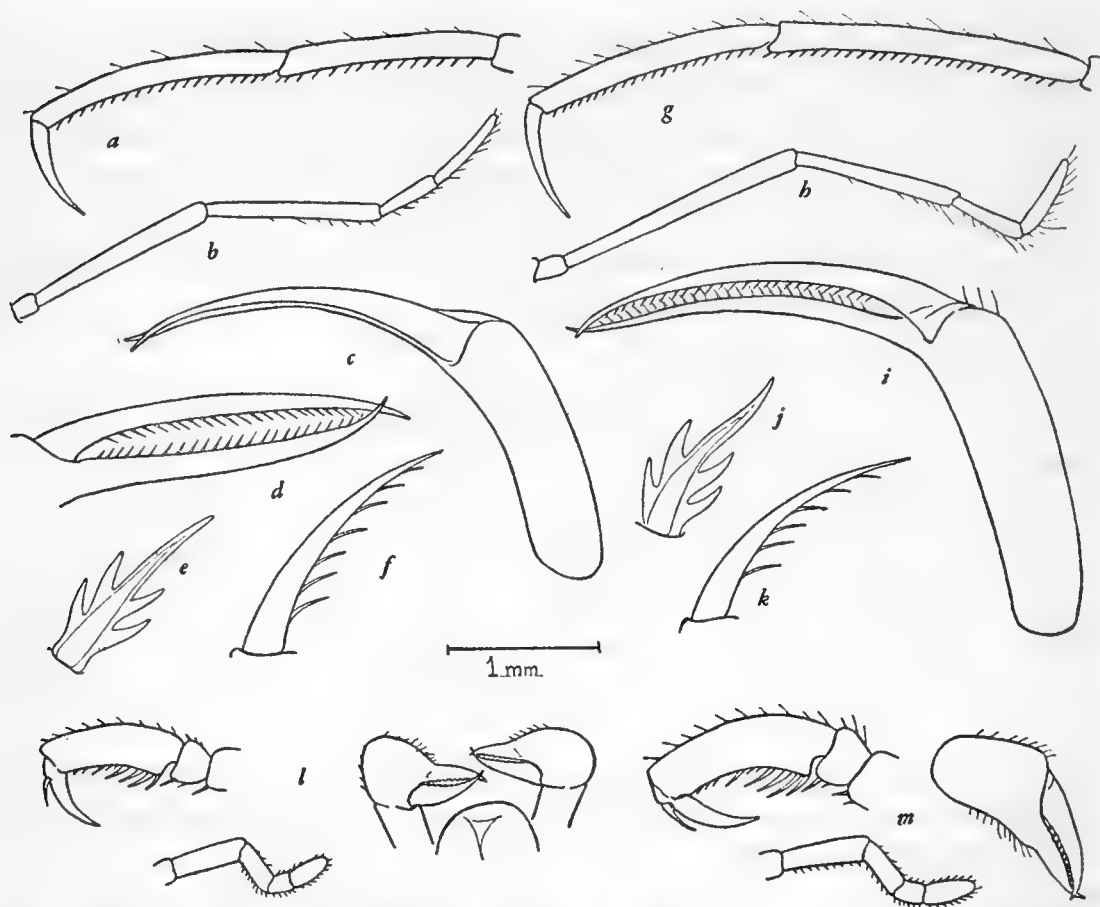


FIGURE 33.—a-f, *Nymphon profundum* Hilton; g-k, *Nymphon noctum* Hilton; l, *Nymphon duospinum* (Hilton); m, *Nymphon quadrispinum* (Hilton). e-f, j, k, greatly enlarged; all others to same scale, as indicated.

1932). In general appearance, and in the conformation of the compound spines of the oviger it resembles *N. hamatum* (*Challenger* stations 146 and 147, Indian Ocean south of Madagascar), but it lacks the projection on the ends of the femur of that species. Except for the fewer denticulations of its compound spines, *N. profundum* is almost identical with *N. procerum* (*Challenger* station 299, in the South Pacific west of Valparaiso). However, *N. profundum* differs from both of Hoek's species in the structure of the terminal claw of the oviger, which bears half a dozen long slender spines instead

of the wedgelike serrations of *N. hamatum* or the numerous close-set spines of *N. procerum*. *Nymphon procerum* and *N. profundum* are based on single female specimens.

NYMPHON NOCTUM Hilton

FIGURE 33, *g-k*

*Nymphon noctum* HILTON, 1942a, p. 3.

*Collecting record*.—Albatross station 2859, latitude  $55^{\circ}20'$  N., longitude  $136^{\circ}20'$  W., 1,569 fathoms, August 29, 1888, 1 ovigerous male, holotype; 1 female; 2 juveniles (paratypes).

With the exception of a longer tarsal joint, this species resembles *N. profundum* and differs from the two blind species described by Hoek in the same particulars as *N. profundum*. In the male specimen there are slight projections at the ends of the femurs, but this process is much less conspicuous than in *N. hamatum*. Except for the longer tarsus and a somewhat heavier investiture of setae, it is inseparable from *N. profundum*, and I do not believe these details are of specific importance. The fourth joint of the male oviger is broadly curved, somewhat less than one-half as long as the fifth, which is straight and narrowly clavate.

NYMPHON MOLUM Hilton

FIGURE 34, *a*

*Nymphon molum* HILTON, 1942a, p. 4.

*Collecting record*.—Albatross station 3439, latitude  $57^{\circ}06'$  N., longitude  $170^{\circ}35'$  W., 41 fathoms, August 3, 1891, 1 ovigerous male, holotype.

This species is characterized by a rather stout terminal claw and small auxiliaries, the lack of large spines on the propodus, and the rather simple spines of the oviger. These spines are smooth or bear but one pair of denticulations. The chelae are moderately long, armed with short teeth. The fourth and fifth joints of the oviger are subequal, straight, not conspicuously swollen distally.

NYMPHON VARIATUM Hilton

FIGURE 34, *b*

*Nymphon variatum* HILTON, 1942a, p. 4.

*Collecting record*.—Albatross station 4245, Kasan Bay, Prince of Wales Island, 95 to 98 fathoms, July 11, 1903, 1 female (?).

This species is based on a single specimen, probably a female, which is broken in half and lacks ovigers. Hence its exact status cannot be ascertained, but it appears to be close to if not identical with *N. pixellae* Scott.

## NYMPHON OCULOSPINUM Hilton

FIGURE 34, c

*Nymphon oculospinum* HILTON, 1942a, pp. 4-5.

*Collecting record.*—Albatross station 3435, latitude  $26^{\circ}45'00''$  N., longitude  $110^{\circ}45'20''$  W., 859 fathoms, April 22, 1891, 1 male, holotype.

In view of the wide range of variation in the *grossipes-mixtum*-

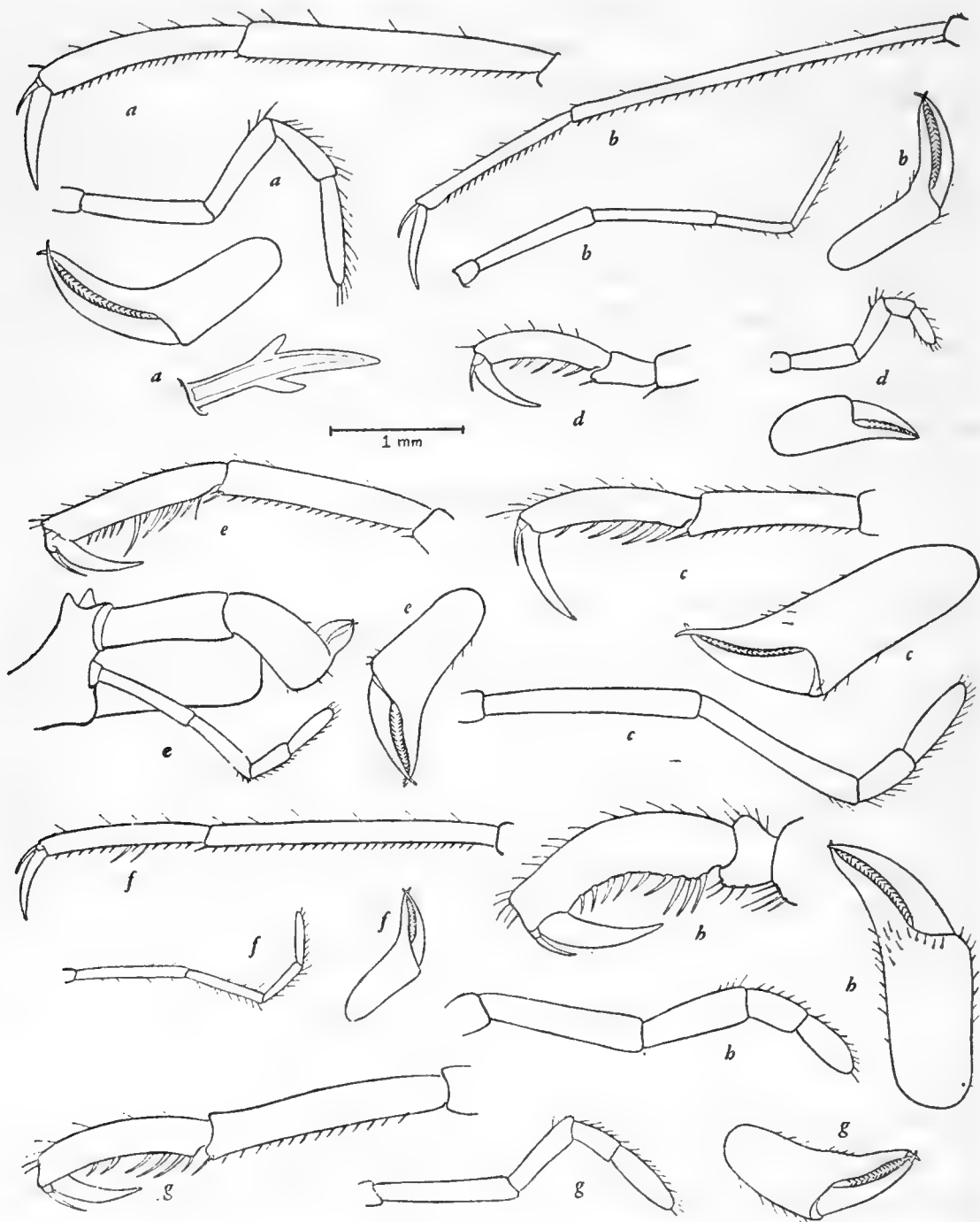


FIGURE 34.—a, *Nymphon nolum* Hilton; b, *Nymphon variatum* Hilton; c, *Nymphon oculospinum* Hilton; d, *Nymphon microcollis* Hilton; e, *Nymphon basispinosum* Hilton; f, *Nymphon elongatum* Hilton; g, *Nymphon nigrognathum* Hilton; h, *Nymphon microsetosum* Hilton. All drawings to same scale, except denticulate spines of *N. nolum*.

*glaciale* group, this species cannot be clearly separated from that complex. The chela is somewhat larger than usual, and the record from 859 fathoms in the Gulf of California is puzzling. As a diagnostic character, Hilton describes the auxiliary claws as "more than half the length" of the terminal. I find them slightly less than half as long. The pointed eye tubercle is not a good character, as it is also found in specimens of *N. grossipes*, and the tip is easily broken off.

NYMPHON MICROCOLLIS Hilton

FIGURE 34, *d*

*Nymphon microcollis* HILTON, 1942a, p. 5.

*Collecting record.*—U.S.R.S. *Corwin*, "Alaska," 1885, 1 female (holotype).

The specimen described under this name does not appear to be separable from *Nymphon brevirostre* Hodge.

NYMPHON BASISPINOSUM Hilton

FIGURE 34, *e*

*Nymphon basispinosum* HILTON, 1942a, p. 5.

*Collecting record.*—*Albatross* station 4788, latitude  $54^{\circ}50'24''$  N., longitude  $167^{\circ}13'$  E., 57 fathoms, June 12, 1906, 1 ovigerous male (holotype).

The prominent conical projections or tubercles over the bases of the chelifores makes this a well-characterized species. In this respect it somewhat resembles *N. striatum* Losina-Losinsky, from which it differs principally in the possession of large spines on the propodus. The designation of the type specimen as a female is evidently a *lapsus calami*: the specimen is an ovigerous male. The long joints of the oviger are subequal, straight.

NYMPHON ELONGATUM Hilton

FIGURE 34, *f*

*Nymphon elongatum* HILTON, 1942a, p. 5.

*Collecting record.*—*Albatross* station 4792, latitude  $54^{\circ}36'15''$  N., longitude  $166^{\circ}57'15''$  W., 72 fathoms, June 14, 1906, 2 males, 1 female, cotypes.

Inasmuch as all three specimens have rather delicate toothed chelae, the diagnosis of "heavy jaws, no teeth" must be revised. The most important diagnostic character is the presence of two large spines near the middle of the propodus. The tarsus is twice as long as the propodus. In one specimen the lateral processes are separated by at least four times the diameter, but the others are less widely separated. The fourth joint of the male oviger is slightly curved, not quite as much as the fifth, which is straight and slightly expanded distally.

## NYMPHON NIGROGNATHUM Hilton

FIGURE 34, *g**Nymphon nigrognathum* HILTON, 1942a, p. 6.

*Collecting record.*—Albatross station 2864, latitude 48°22' N., longitude 122°51' W., 48 fathoms, September 6, 1888, 1 ovigerous male, holotype.

This species cannot be clearly separated from the *grossipes-mixtum-glaciale* complex. Hence I regard it as a synonym of *N. grossipes*.

## NYMPHON MICROSETOSUM Hilton

FIGURE 34, *h**Nymphon microsetosum* HILTON, 1942a, p. 6.

*Collecting record.*—Albatross station 4777, latitude 52°11' N., longitude 179°49' E., 43–52 fathoms, June 4, 1906, 2 specimens, cotypes.

The presence of short stiff setae over the trunk, scape, and proximal joints of the legs characterizes this species. The combination of rather large size and very short tarsus is not common in this genus. The fourth and fifth joints of the oviger are straight, subequal.

## NYMPHON DUOSPINUM (Hilton)

FIGURE 33, *l**Chaetonymphon duospinum* HILTON, 1942a, p. 6.

*Collecting record.*—Kiska Harbor, Alaska, 10 fathoms, 1873, W. H. Dall collector, 1 female ?, holotype.

According to the diagnosis this species has but two basal spines on the propodus. This is not so. As can be seen from the figure there are at least four, as in the following species. Except for the compact trunk this species is closely related to *N. microsetosum* Hilton.

## NYMPHON QUADRISPINUM (Hilton)

FIGURE 33, *m**Chaetonymphon quadrispinum* HILTON, 1942a, p. 7.

*Collecting record.*—Kiska Harbor, Alaska, 19 fathoms, 1873, W. H. Dall collector, 1 female ?, holotype.

There is no substantial difference between the two specimens designated as types for *Chaetonymphon duospinum* and *quadrispinum*, except that the latter specimen is somewhat larger and more intact.

## Family PALLENIDAE Wilson, 1878

The author agrees with Marcus (1940, p. 128) that it is not necessary to change this family name although *Pallene*, the type genus, is a preoccupied name and has been replaced by *Callipallene* Flynn (1929). This usage has been explained in a previous paper (1948, pp. 199–201) and finds support in the views expressed by Berg in his "Classification of Fishes" (1947, p. 354), who prefers the family names that have received wide usage in ichthyology.

The Pallenidae are represented in Japanese waters by two species of *Callipallene*, four of *Pallenopsis*, and one of *Propallene*. Loman (1911, p. 13) reported a "*Pallenopsis* n. sp.?" from Sagami Bay, which unfortunately was not figured. He remarked upon its similarity to *Pallenopsis fluminensis*, and it evidently represents still another species of this genus in Japanese waters, but it is probably not identifiable with *P. fluminensis*.

The interesting little *Decachela discata*, described from Pacific Grove by Hilton (1942c) was taken by the *Albatross* west of Hokkaido. It does not, in my opinion, deserve unique family status, although its structure suggests a transition between the Pallenidae and Tanystylidae. Its oviger is of the typical pallenid type.

## Genus CALLIPALLENE Flynn, 1929

Represented in Japanese waters by *Callipallene amaxana* (Ohshima), taken in pelagic tows at night, and by *C. dubiosa*, which may be closely related to *C. novo-zealandae* (Thomson). *Callipallene amaxana* differs from the latter species in having no auxiliary claws.

## CALLIPALLENE DUBIOSA, new species

## FIGURE 35

*Paratypes* (2 females).—U.S.N.M. No. 80577, *Albatross* shore trip, Hakodate, July 3, 1906.

*Description*.—Trunk close set but not compact, segmentation complete, lateral processes well separated, slightly longer than broad. Neck a narrow constriction separating trunk and base of chelifores. Eye tubercle rounded, about twice as high as broad. Eyes distinct but lightly pigmented.

Proboscis shaped somewhat like the small end of an egg, not quite twice as long as width at base.

Chelifore scape curved, heavy, twice as long as broad. Chelae rounded at base, with flat, close-set jaws with serrated opposing edges.

Third leg rather short for this genus, second tibia markedly longer than the first. Femur distended. Propodus thick-set, curved, with



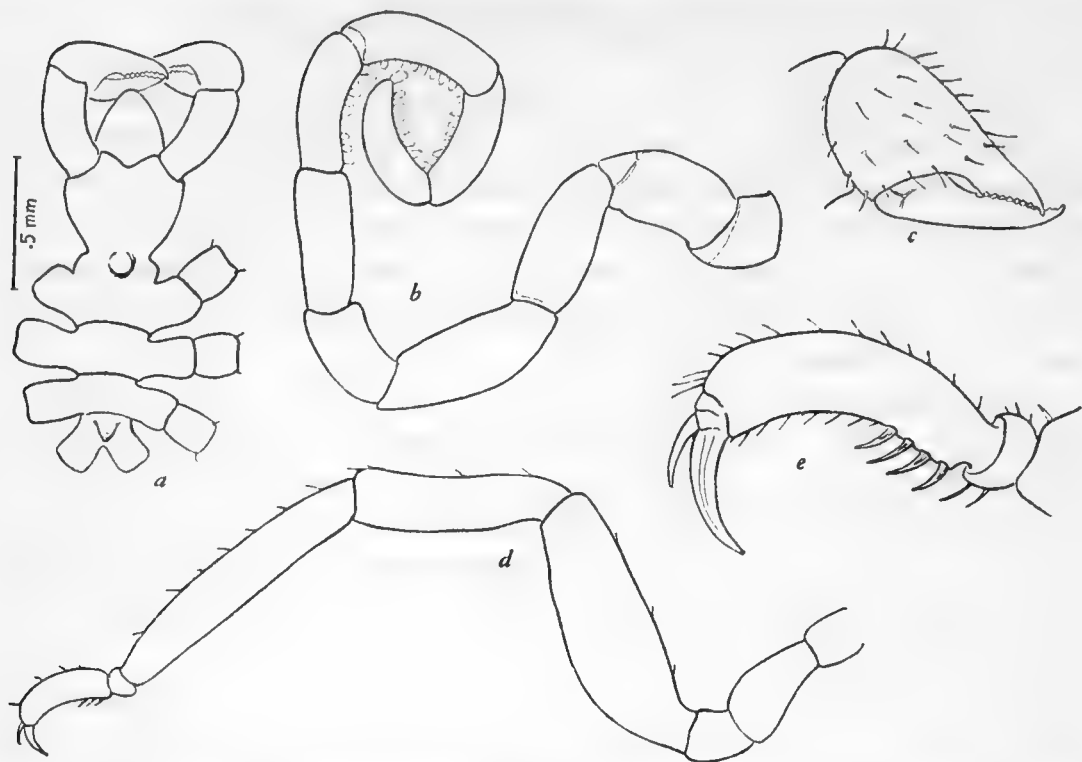


FIGURE 35.—*Callipallene dubiosa*, new species: *a*, Dorsal view of trunk; *b*, oviger; *c*, chela; *d*, third leg; *e*, tarsus and propodus.

four large basal spines. Terminal claw less than half as long as propodus, auxiliaries about half as long as terminal claw.

Oviger joints all somewhat short, four terminal joints bearing seven or eight flat denticulated spines on each joint.

*Measurements*.—As follows:

	Mm.	Third leg:	Mm.
Length of proboscis.....	0.3	First coxa.....	0.2
Length of trunk.....	1.1	Second coxa.....	.4
Second lateral process, width.....	.7	Third coxa.....	.25
Length of scape.....	.3	Femur.....	1.1
Chela.....	.5	First tibia.....	.75
		Second tibia.....	1.1
		Tarsus.....	.1
		Propodus.....	.6
		Terminal claw.....	.25
		Auxiliary claw.....	.1

*Remarks*.—The closest relative of this species appears to be *Callipallene novo-zealandae* (Thomson, 1884), which is described as having “narrow, slightly curved” chelae. The chelae of *C. dubiosa* are rather robust, with comparatively heavy, straight fingers. The New Zealand species is figured with large slender spines on the propodus and an investiture of rather long setae, whereas this Japanese form has four

large spines and not so many large setae on the propodus. In general appearance *Callipallene dubiosa* also resembles *C. pectinata* (Calman, 1923), but it lacks the peculiar pectinate auxiliary claws of that species. Calman's specimen was a male, however, and both these specimens are females. If this character proves to be a sexual one, it may be necessary to consider the two species identical.

**Genus PALLENOPSIS Wilson, 1881**

**PALLENOPSIS MOLLISSIMA (Hoek)**

FIGURE 36, *f*

*Phoxichilidium mollissimum* HOEK, 1881, pp. 87–88, pl. 13, figs. 6–9.

*Pallenopsis mollissima* SCHIMKEWITSCH, 1893, pp. 41–42, pl. 2, fig. 24.

*Collecting records.*—*Albatross* stations 4975 (1 ovigerous male, 1 female); 5080 (1 female).

This species was described from a single incomplete specimen from *Challenger* station 237, latitude 34°37' N., 140°32' E., 1,875 fathoms, which was without tarsi. The description was completed by Schimke-witsch (1893), who examined a specimen taken by the *Albatross* in the eastern Tropical Pacific, at station 3360.

Evidently the range of this species comprises the deeper waters of the North Pacific, between latitudes 6° and 35° N. Both the Japanese records are off southern Honshu.

**PALLENOPSIS TYDEMANI Loman**

FIGURE 36, *i, j*

*Pallenopsis tydemani* LOMAN, 1908, pp. 65–66, pl. 10, figs. 139–145.

*Collecting record.*—*Albatross* station 4908 (1 female).

Previously reported by Loman from *Siboga* stations 45 and 314, 794 and 694 meters. The stations are both north of Soembawa, in the Dutch East Indies, and this record extends the range to southwest of Honshu.

**PALLENOPSIS VIRGATUS Loman**

FIGURE 36, *g, h*

*Pallenopsis virgatus* LOMAN, 1908, pp. 69–70, pl. 9, figs. 135–136.

*Collecting record.*—*Albatross* station 3730 (1 male).

Described by Loman from *Siboga* station 310, latitude 8°30' S., longitude 119°7.5' E., 73 meters. It is evidently a shallow-water

species. Loman's figure indicates the presence of small tubercles on the dorsal margin of the first coxae. I find these present, usually in pairs, on this specimen.

**PALLENOPSIS STYLIROSTRE, new species**

**FIGURE 36, a-e**

*Types*.—Holotype (male); U. S. N. M. No. 80554, *Albatross* station 4975, latitude  $33^{\circ}21'30''$  N., longitude  $135^{\circ}38'50''$  E., 545–712 fathoms,  $37.5^{\circ}$ , August 31, 1906.

Paratype (ovigerous male): *Albatross* station 4970, latitude  $33^{\circ}23'30''$  N.,  $135^{\circ}36'30''$  E., 500–649 fathoms,  $39.1^{\circ}$ , August 30, 1906.

*Description*.—Trunk oval in outline, segmentation well marked, lateral processes separated by about their own width. Eye tubercle slightly higher than wide, roundly pointed at posterior end, the eyes unequal in size.

Proboscis about as long as trunk, pointed downward, broadly styliiform, blunt at tip.

Chelifore: Scape 2-jointed, long and slender but not quite as long as proboscis. Chelae small, rounded, with small curved pincers without spines or denticulations.

Abdomen about three times as long as broad, rounded at tip.

Third leg long, slender, straight, without prominent tubercles, processes, or spines. Propodus small, with two or three large basal spines, and several broad wedge-shaped spines on the sole. Terminal claw almost as long as propodus, auxiliaries about one-fifth as long as terminal claw.

Oviger of the usual recurved type in the genus, with the sixth segment markedly curved. The terminal segments are adorned with long slender spines.

*Measurements*.—As follows:

	Holo- type, ♂ Mm.	Para- type, ♂ Mm.
Proboscis.....	3.9	4.1
Trunk.....	4.5	5.0
Second lateral process, width.....	2.25	3.4
Abdomen.....	1.25	2.0
Scape.....		3.7
Third leg:		
First coxa.....	1.0	1.5
Second coxa.....	2.5	3.5
Third coxa.....	1.0	1.5
Femur.....	6.0	9.0
First tibia.....	6.9	9.5
Second tibia.....	7.25	11.5
Tarsus and propodus.....	1.4	1.6

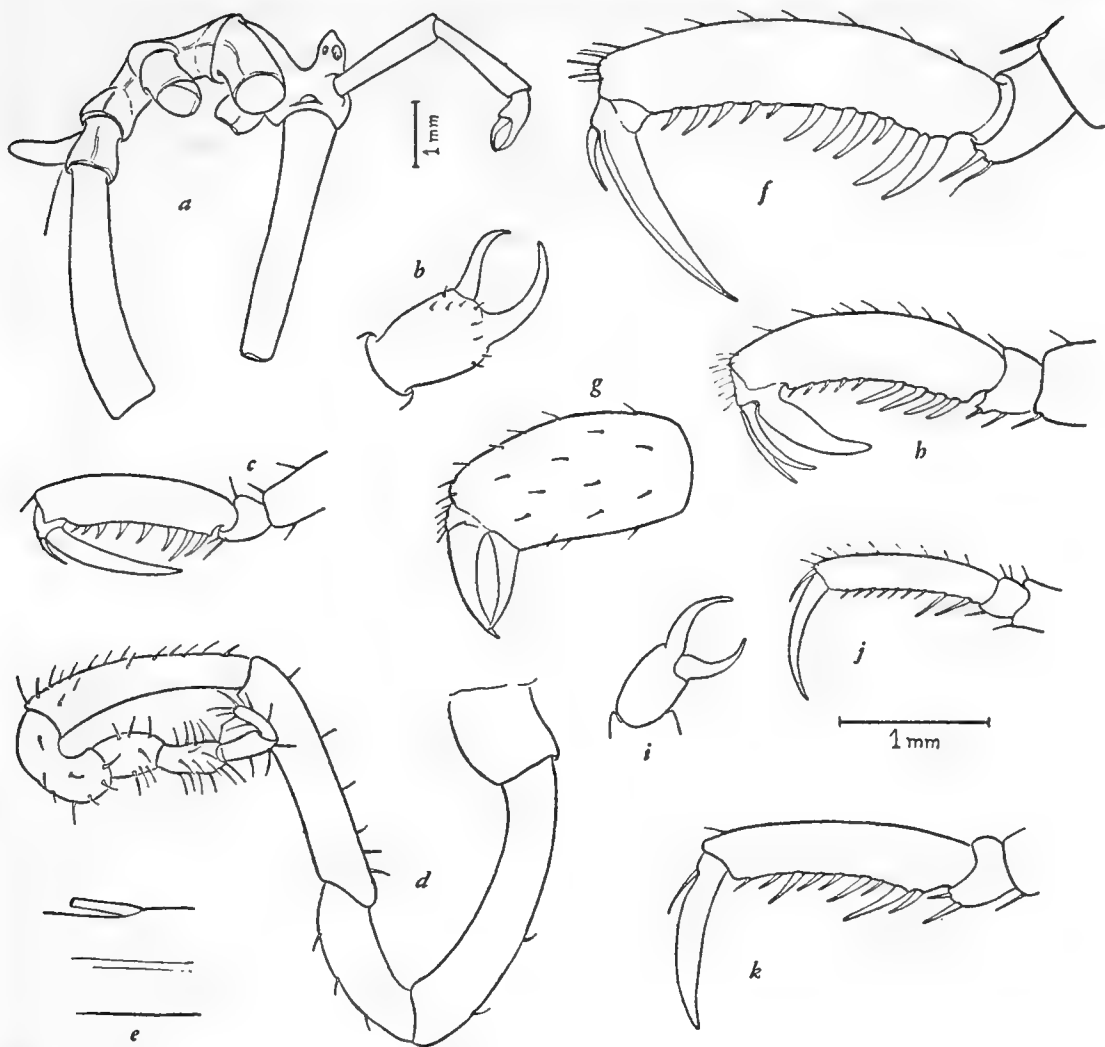


FIGURE 36.—*a-e*, *Pallenopsis stylirostre*, new species: *a*, Lateral view, paratype; *b*, chela; *c*, tarsus and propodus; *d*, oviger; *e*, femoral cement gland. *f*, *P. mollissima* (Hoek): Tarsus and propodus. *g, h*, *P. virgatus* Loman: *g*, Chela; *h*, tarsus and propodus. *i, j*, *P. tydemani* Loman: *i*, Chela; *j*, tarsus and propodus. *k*, *P. profunda* Hilton: Tarsus and propodus.

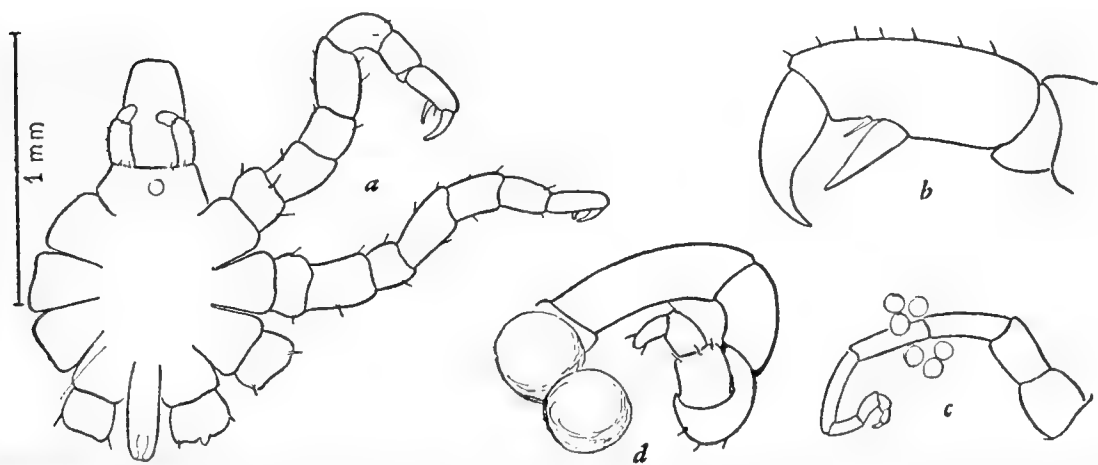


FIGURE 37.—*D. cachela discata* Hilton (holotype): *a*, Dorsal view; *b*, tarsus and propodus; *c*, oviger; *d*, detail of oviger.

*Remarks.*—This species bears a superficial resemblance to *P. tydemani* in its general appearance and the conformation of the proboscis, but it has a well-developed eye tubercle with functional eyes, and the propodus is much shorter, with heavier spines on the sole than *P. tydemani*. Hilton's (1942c) *Pallenopsis profunda* from the Bering Sea has a similar proboscis, but the structure of the propodus is different and it is much larger in proportion to the size of the animal (fig. 36, k). This species appears to be a deep-water form of the subtropical latitudes, as both Japanese records are off southern Honshu.

Genus DECACHELA Hilton, 1939

DECACHELA DISCATA Hilton

FIGURE 37

*Decachela discata* HILTON, 1939a, p. 34; 1942e, p. 70.

*Collecting record.*—*Albatross* station 4987, latitude 43°19'20'' N., longitude 140°17' E., 59 fathoms, August 20, 1906, 44.8° F., 1 female.

This specimen shows no significant differences from the holotype specimen, from which the accompanying figures were drawn. As can be seen from these figures, the chelate structure on which Hilton based the family Decachelidae is actually a modified basal spine of the propodus and the legs are eight-jointed instead of "apparently seven jointed." Apparently this small form has been overlooked, for its occurrence in both Japan and California suggests a wide distribution along the shores of the North Pacific. This record is off the west coast of Hokkaido.

Family PHOXICHILIDIIDAE Sars, 1891

Although this family is not well represented in Japanese waters, there are a number of interesting forms which cause more confusion than light shed on the status of the genera involved. The differences between *Phoxichilidium* and *Anoplodactylus* are tenuous enough, and the occurrence of two species that would probably be referred to *Anoplodactylus* by some taxonomists, but which possess well-developed auxiliary claws and incompletely segmented ovigers, characters associated with *Phoxichilidium*, opens questions concerning the validity of *Anoplodactylus* as an independent genus. A critical examination of this problem must await more material, however.

Genus PHOXICHILIDIUM Milne-Edwards, 1840

This genus is represented in Japanese waters by two hitherto undescribed species; the ubiquitous *Phoxichilidium femoratum* of the North Atlantic and Northeastern Pacific is so far unreported from this

region. *Phoxichilidium* is characterized by a 5- or 6-jointed oviger, the possession of auxiliary claws, and, in comparison with *Anoplodactylus*, a relatively shorter dorsal prolongation of the cephalic segment and a correspondingly less ventral origin of the proboscis. In the two species described below, however, this character of the cephalic segment is closer to *Anoplodactylus* than to the other species of *Phoxichilidium*; hence I should further characterize *Anoplodactylus* by the possession of a localized femoral cement gland in the male, although this is not always present. In both of these species the cement gland is represented by a row of pores along the dorsal surface of the femur.

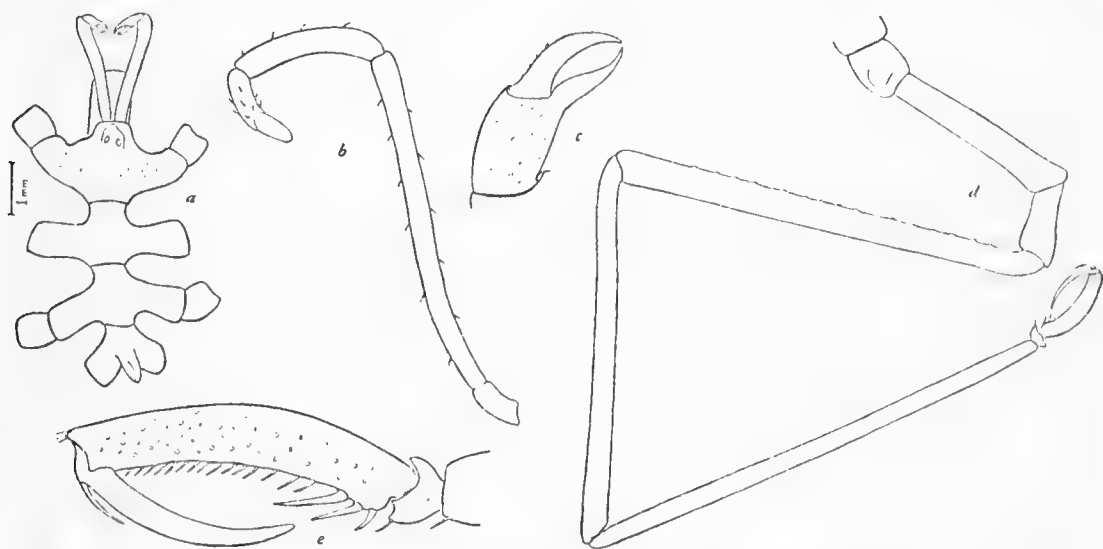


FIGURE 38.—*Phoxichilidium ungellatum*, new species: *a*, Dorsal view of trunk; *b*, terminal joint of oviger; *c*, chela; *d*, third leg; *e*, tarsus and propodus.

**PHOXICHILIDIUM UNGELLATUM, new species**

**FIGURE 38**

*Types*.—Holotype (male): U.S.N.M. No. 80542, *Albatross* station 4842, latitude  $36^{\circ}13'$  N.,  $133^{\circ}27'$  E., 82 fathoms,  $54.6^{\circ}$  F. July 26, 1906.

Paratypes (4 females, 1 ovigerous male): Same locality.

*Additional collecting records*.—*Albatross* stations 4803 (1 female); 4826 (1 male); 4891 (1 ovigerous male); 4958 (1 female); 4969 (1 female); 4973 (1 male); 5079 (3 females); 5080 (1 female).

*Description*.—Trunk oval in outline, completely segmented, lateral processes well separated by about their own diameter. Without tubercles, processes, or spines. Eye tubercle rounded to sharply pointed, two to three times as tall as width at base, with large well-developed eyes.

Proboscis cylindrical, blunt at tip, with a slight constriction near distal third, inserted ventrally at about the middle of the cephalic segment.

Chelifore: Scape long, slender, curved. Chelae small, with curved, opposing fingers which are without spines or teeth on the inner surface. There is a low inconspicuous spiny cushion on the dactylus, with short spines sparsely scattered on its surface.

Abdomen erect, about twice as long as wide, rounded at tip.

Oviger inserted on first lateral process about halfway from center of cephalic segment. The third segment is long and relatively straight, with a slight curve proximally. There is an incomplete, nonarticulated segmentation near the base. Fourth segment about five times as long as wide, curved, with a few small spines. Fifth segment with a nonarticulated segmentation near the middle; proximal half adorned with scattered recurved spines, distal half bare, palpiform.

Third leg long, slender, straight, without prominent spines or tubercles. First coxae short, about as broad as long, third coxa one and one-half times as long as first, second nearly twice as long as both first and third together. Femur and tibiae straight, sticklike, without conspicuous spines or tubercles. Tarsus very short, propodus long, curved, with two very large basal spines and a smaller one on the corner of the heel, and about 15 smaller spines on the sole. Terminal claws three-fourths or four-fifths as long as propodus, slightly curved. Auxiliaries slender, about one-fifth as long as terminal claw. The genital pore of the female was apparent on a low mound of the first coxae: I could not find it on any of the other legs. In the male it occurs on the last two pairs of legs as a low tubercle on the first coxae. There is a row of 15 or more small pores on the dorsal surface of the femur, indicating the apertures of the cement glands.

*Measurements.*—As follows:

	<i>Mm.</i>	Third leg:	<i>Mm.</i>
Proboscis .....	2.75	First coxa .....	1.0
Trunk .....	4.75	Second coxa .....	4.0
Second lateral process, width .....	3.2	Third coxa .....	1.6
Scape .....	2.75	Femur .....	8.0
Chela .....	1.0	First tibia .....	8.0
Abdomen .....	.8	Second tibia .....	9.0
		Tarsus .....	.2
		Propodus .....	1.9
		Terminal claw .....	1.25
		Auxiliary claw .....	.3

*Remarks.*—Although this material establishes a rather wide bathymetric range (82–587 fathoms) for this species, I could see no significant difference between the specimens from various depths. The num-



ber of spines on the base of the propodus is apparently variable; in some specimens there are four. The color varied, in alcohol, from light straw to a bright reddish brown. The distribution, according to these collections, is from north of Hokkaido to west of Kyushu, and south of Honshu. The southern stations are in deeper water.

This species closely resembles *Phoxichilidium micropalpidum* Hilton (1942f, p. 72), described from *Albatross* station 4792, latitude  $54^{\circ}36'15''$  N., longitude  $166^{\circ}57'15''$  E., 72 fathoms. It differs from this species in having a longer femur with 15 instead of 5 femoral pores, in having a longer third joint of the oviger, and in having auxiliary claws less than a third as long as the terminal claw, whereas those of Hilton's species are half as long.

**PHOXICHILIDIUM HORRIBILIS, new species**

**FIGURE 39**

*Types*.—Holotype (male): U.S.N.M. No. 80538, *Albatross* station 4803, latitude  $46^{\circ}42'$  N., longitude  $151^{\circ}45'$  E., 229 fathoms,  $35.9^{\circ}$  F., June 24, 1906.

Paratype (ovigerous male): Same locality.

*Description*.—Trunk oval in outline, completely segmented, lateral processes separated by slightly more than their own diameter. There are no tubercles, processes, or spines on the trunk or lateral processes. Eye tubercle bluntly conical, with four well-developed eyes about midway between base and tip.

Proboscis blunt at tip, constricted near distal third, not quite as long as trunk.

Chelifore: Scape straight, moderately heavy, about as long as the chela. Chela large, arcuate or scythe shaped, with a row of 15 or 20 large, long teeth on each finger.

Abdomen erect, small, rounded at tip.

Oviger inserted ventrally near the base of the lateral process instead of halfway out. Third segment broadly arched, with a non-articulated constriction near the base. Fifth segment with a non-articulated constriction near the middle, the basal half with a few recurved spines, distal half palpiform, bare.

Third leg moderately long, without conspicuous spines or tubercles. The second coxa is about as long as the first and third together, but the first coxa is less than half as long as the third. Tarsus short, propodus heavy, strongly curved, with a conical projection at the end. There are four large basal spines on the heel, a pair of shorter spines near the middle of the sole, and a double row of small spines along the sole, with a somewhat larger spine at the distal end of the row. Terminal claw heavy, curved, about half as long as propodus; auxiliaries about half as long as terminal claw. Genital pore on midventral surface

of second coxa. Femoral cement gland openings a row of 7 to 8 small pores along dorsal surface of femur.

*Measurements.*—As follows:

	Mm.	Third leg:	Mm.
Proboscis -----	ca. 2.25	First coxa -----	0.6
Trunk -----	4.0	Second coxa -----	2.25
Second lateral process, width ----	2.4	Third coxa -----	1.4
Scape -----	1.9	Femur -----	4.0
Chela -----	ca. 1.8	First tibia -----	3.4
		Second tibia -----	4.6
		Tarsus -----	.25
		Propodus -----	1.5
		Terminal claw -----	.7
		Auxiliary claw -----	.4

*Remarks.*—The large conspicuous chelae separate this species from any other in the family, as well as in the genus, and suggest the proposed specific name. The locality is the southern Sea of Okhotsk just north of the Kurile chain.

#### Genus ANOPLODACTYLUS Wilson, 1878

##### ANOPLODACTYLUS GESTIENS (Ortmann)

##### FIGURE 40, a-d

*Phoxichilidium gestiens* ORTMANN, 1891, p. 166, pl. 24, fig. 8.

*Anoplodactylus gestiens* LOMAN, 1911, p. 13.

?*Anoplodactylus gestiens* OHSHIMA, 1933c, p. 219.

*Anoplodactylus gestiens* OHSHIMA, 1936, p. 864.

*Collecting records.*—*Albatross* stations 3703 (1 female); 3715 (1 female); 3739 (1 ovigerous male).

The cement gland opening in this species is an inconspicuous tubular process about midway on the dorsal surface of the femur. The origin of the ovigers is well out on the first lateral process, as in *A. typhlops* Sars and *A. neglectus* (Hoek).

##### ANOPLODACTYLUS species

##### FIGURE 40, e-g

*Collecting records.*—*Albatross* stations 5075 (1 female); 5078 (1 female).

Both specimens appear to be the same species, in spite of the large difference in depth from which they were taken. Their nearest relative appears to be the western Atlantic *A. lentus* Wilson, but the chelae are somewhat straighter and heavier than in *A. lentus*, and there is no vestige of an auxiliary claw as in Wilson's species. In the absence of male specimens it cannot definitely be referred to any

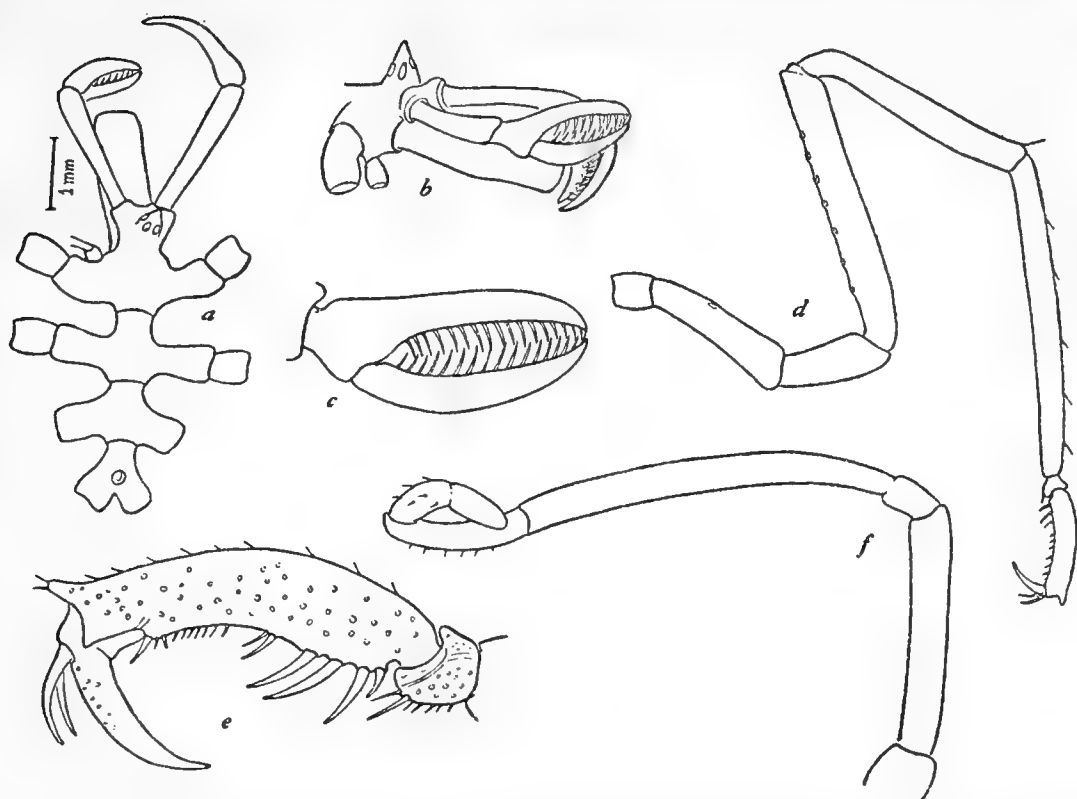


FIGURE 39.—*Phoxichilidium horribilis*, new species: *a*, Dorsal view of holotype; *b*, lateral view of anterior end; *c*, chela; *d*, third leg; *e*, tarsus and propodus; *f*, oviger.

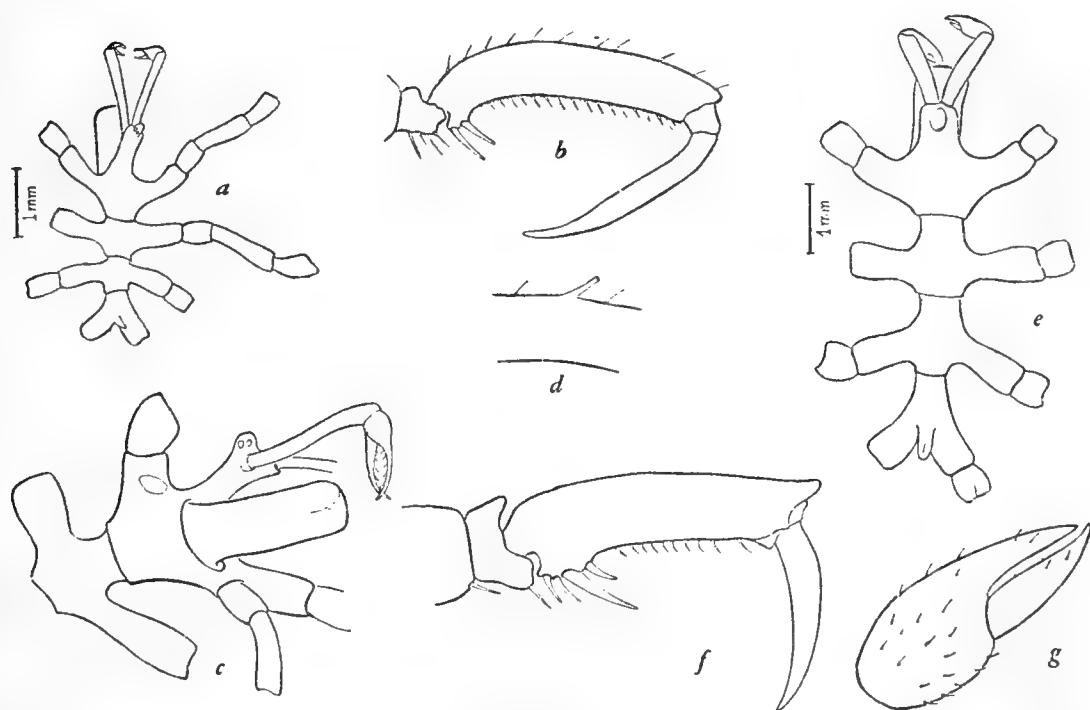


FIGURE 40.—*a-d*, *Anoplodactylus gestiens* Ortmann: *a*, Dorsal view of trunk; *b*, tarsus and propodus; *c*, lateroventral view of anterior end; *d*, femoral cement gland of male. *e-g*, *Anoplodactylus* sp.: *e*, Dorsal view of trunk; *f*, tarsus and propodus; *g*, chela.

particular species, however, as there are no salient characters by which it can be identified. It is a large form, as can be seen by the specimen from station 5075.

*Measurements*.—As follows (specimen from station 5075):

	Mm.	Third leg:	Mm.
Proboscis -----	3.5	First coxa-----	ca. 1.0
Trunk -----	6.0	Second coxa-----	2.0
Second lateral process, width----	4.6	Third coxa-----	.8
Scape -----	.5	Femur -----	14.5
		First tibia-----	12.5
		Second tibia-----	17.5
		Tarsus -----	---
		Propodus -----	---

Both localities from which this form was taken are south of Honshu.

### Family AMMOTHEIDAE Dohrn, 1881

Inasmuch as *Nymphonella tapetis*, for which Ohshima (1938) erected a new family, is actually an aberrant *Ascorhynchus*, I believe it should be retained in the Ammotheidae. It evidently owes its structural differences (which are confined to the anterior end, specifically the first pair of legs and the palpus), to its parasitic habit. If any specimens of this peculiar pycnogonid were collected by the *Albatross*, they must still be inside clam shells, for clams seem to be its preferred host. The adults, however, have been found free-living in sand. For further information on the history of this species, see Ohshima's various papers and Arita (1937).

Although this parasitic species is so far known only from Japan, it is possible that it may be of wider occurrence and will be discovered elsewhere. It would seem logical to expect it on the California coast.

The taxonomic relationship of *Nymphonella* to *Ascorhynchus* would seem to be confirmed by the occurrence of six species of *Ascorhynchus* in or near Japan, most of them in or near Sagami Bay. This is more than have been found anywhere else in as restricted a locality.

### Genus ACHELIA Hodge, 1864

#### ACHELIA BOREALIS (Schimkewitsch)

#### FIGURE 41, h-m

*Ammothea borealis* SCHIMKEWITSCH, 1895, pp. 36-40, pl. 2, figs. a-b; 1907, pp. 5-9, pl. 1; 1930, pp. 139-144, figs. 34-37.

*Ammothea borealis* var. *japonica* LOSINA-LOSINSKY, 1933, pp. 57-59, fig. 9.

*Achelia borealis* HEDGPETH, 1947, pp. 24, 27, fig. 13b.

*Collecting record*.—*Albatross* station 5037, latitude 42°02'40'' N., longitude 142°33'20'' E., 175-349 fathoms, October 1, 1906, 37.9° F., 1 ovigerous male.

The general appearance of this animal, together with the long slender propodus and moderately spiny legs, places it close to this species, although Schimkewitsch's figures leave much to be desired.

This specimen is a curious abnormality, with three legs on the right side and four on the left (fig. 41, *h*). The larger distal end of the middle lateral process suggests a limb bud or rudimentary socket for the missing leg. There is no evidence that this is a result of regeneration after an injury. This and other abnormalities are discussed in more detail in another paper (Hedgpeth, 1947).

The locality for this collection is near the southern coast of Hokkaido.

**ACHELIA PRIBILOFENSIS (Cole)**

*Ammothea pribilofensis* COLE, 1904, pp. 270-273, pl. 12, fig. 6; pl. 18, figs. 7, 8; pl. 19, figs. 1-8.

*Ammothea (Achelìa) pribilovensis* SCHIMKEWITSCH, 1930, pp. 156-160, figs. 46-49.

*Collecting record*.—*Albatross* shore trip, Milne Bay, Simushiru, June 23, 1906, 2 females.

This record of two females, one a full-grown mature specimen, extends the range of this species from the Pribilofs to the central Kuriles.

**ACHELIA SUPERBA (Loman)**

*Ammothea superba* LOMAN, 1911, pp. 11-12, pl. 1, figs. 14-15; pl. 2, figs. 16-24.—OHSHIMA and KISHIDA, 1947, p. 1008, fig. 2860.

*Collecting records*.—*Albatross* station 5021, latitude 48°32'30'' N., longitude 145°07'30'' E., 73 fathoms, September 27, 1906, 30.9°, 1 female.

This specimen falls well with the bathymetric range of 80-150 meters established by Loman.

**ACHELIA BITUBERCULATA, new species**

**FIGURE 41, *a-g***

*Holotype (male)*: U.S.N.M. No. 80575, Misaki, Sept. 1, 1929. Corallines.

*Description*.—Trunk compact, disk-shaped, segmentation not marked, lateral processes touching. At the anterior corner of each lateral process is a pair of small tubercles which appear to be fused at the base, and on the posterior corner there is a larger, single tubercle. There are small spines at the apices of each tubercle. The eye tubercle is tall and slender, with well-marked eyes near the summit. There are two dorsal trunk tubercles, about half the diameter of the eye tubercle and about the same height. The second tubercle rises immediately anterior to the origin of the abdomen. The integument is granular, heavily pigmented; color deep brown.

Proboscis as long as the trunk, broadly oval.

Chelifore one-third as long as proboscis, with a globular subchela.

Palpus slightly longer than proboscis, the four terminal joints with ventral lobes, giving it a serrate appearance.

Abdomen slender, fingerlike, slightly dilated toward the distal third, reaching to end of the first coxae. It is adorned with a few sets of short spines.

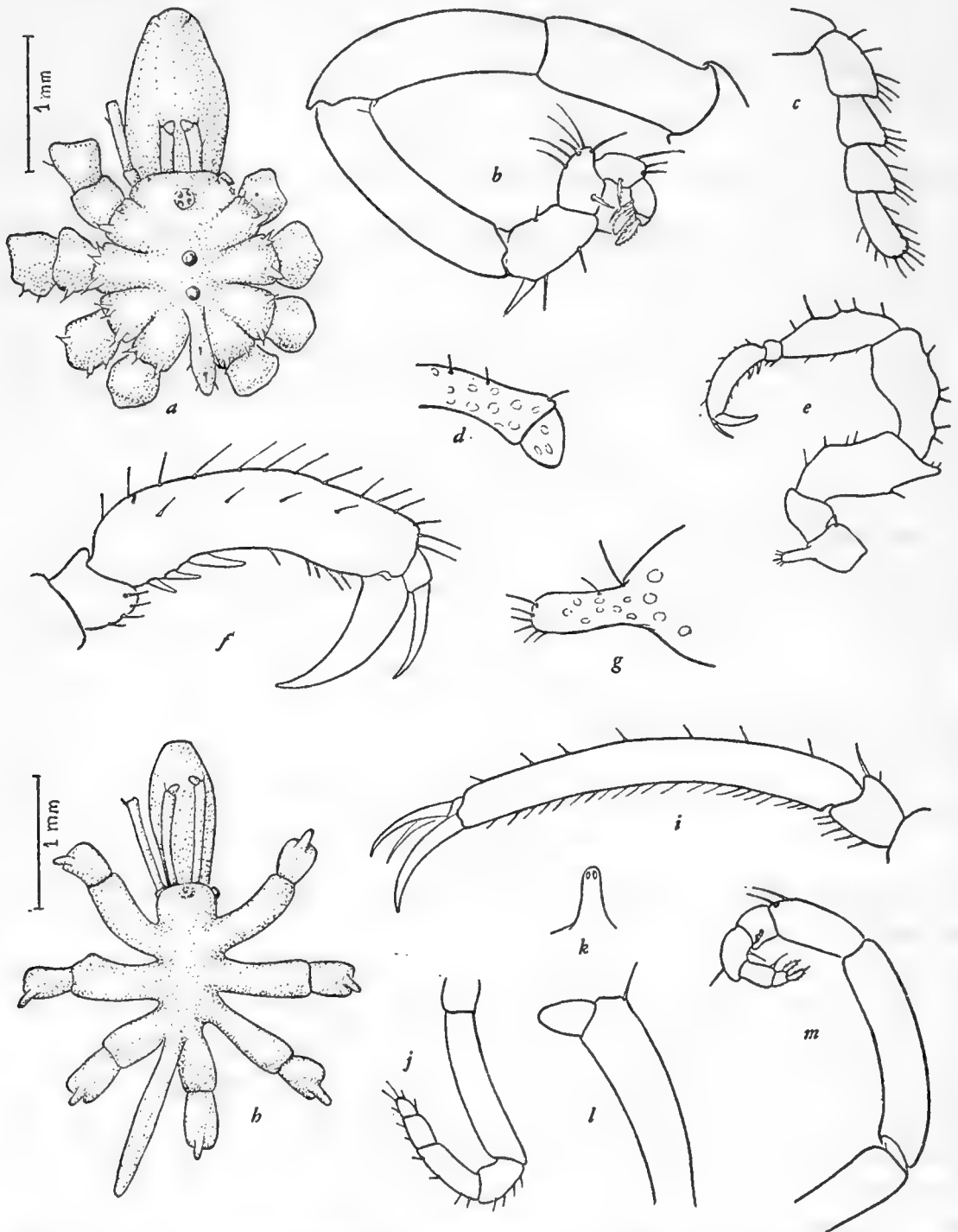


FIGURE 41.—a-g, *Achelia bituberculata*, new species: a, Dorsal view of holotype; b, oviger; c, terminal joints of palpus; d, chelifore; e, third leg; f, tarsus and propodus; g, genital protuberance. h-m, *A. borealis* (Schimkewitsch): h, Dorsal view; i, tarsus and propodus; j, palpus; k, eye tubercle; l, chelifore; m, oviger.

Third leg short, knobby and spinose. The genital process is on the ventral distal corner of the second coxae of the last two pairs of legs, about two-thirds as long as the width of the coxal joint. There is a tuft of short heavy spines at the tip. Tarsus short, propodus curved, with three large spines on heel. Terminal claw broad, half as long as propodus. Auxiliary claw more than half as long as terminal claw.

Oviger rather heavy, 9-jointed, with a heavy reversed spine at the base of the sixth segment, a tuft of long spines on the outer distal edge of the seventh, and two denticulate spines on the eighth segment, three on the ninth.

Measurements.—As follows:

	Mm.	Third leg:	Mm.
Proboscis -----	1. 25	Coxae -----	1. 0
Trunk -----	1. 50	Femur -----	1. 0
Second lateral process, width---	1. 4	First tibia-----	. 98
Abdomen -----	. 6	Second tibia-----	. 8
		Tarsus -----	. 1
		Propodus -----	. 75
		Terminal claw-----	. 4

Remarks.—This species appears to be close to *A. litke* Losina-Losinsky but differs from that species in having dorsal trunk tubercles. Other species with tall dorsal trunk tubercles are *A. assimilis* (Haswell) and *A. wilsoni* (Schimkewitsch), from which it differs in the possession of the peculiar birfurcate tubercles on the anterior corners of the lateral processes.

ACHELIA species

*Albatross* shore trip, Milne Bay, Shimushiru, June 23, 1906, 1 immature.

This appears to be the immature form of one of the compact spinose species. The fingers of the chelae are straight and the specimen differs in other respects from the immature form from the Kuriles ascribed by Ohshima to *A. alaskensis*. It may be the Oriental or Japanese variety of *A. echinata*.

Genus AMMOTHELLA Verrill, 1900

AMMOTHELLA PROFUNDA, new species

FIGURE 42

*Holotype (female).—*U.S.N.M. No. 80567, *Albatross* station 5083, latitude 34°04'20'' N., longitude 137°57'30'' E., 624 fathoms, 38.1° F., October 20, 1906.

*Description.*—Trunk oval in outline, segmentation not marked by suture lines; the lateral processes diverging. Integument lightly



granular, without any knobs, tubercles, or processes. There is a small spine at the anterior and posterior corners of the lateral processes. Eye tubercle erect, leaning forward, bluntly pointed, without eyes.

Proboscis as long as trunk, bluntly ovoid, directed downward.

Chelifore somewhat more than half as long as proboscis, with conspicuous spines on the scape. Chela rudimentary, with small processes instead of fingers.

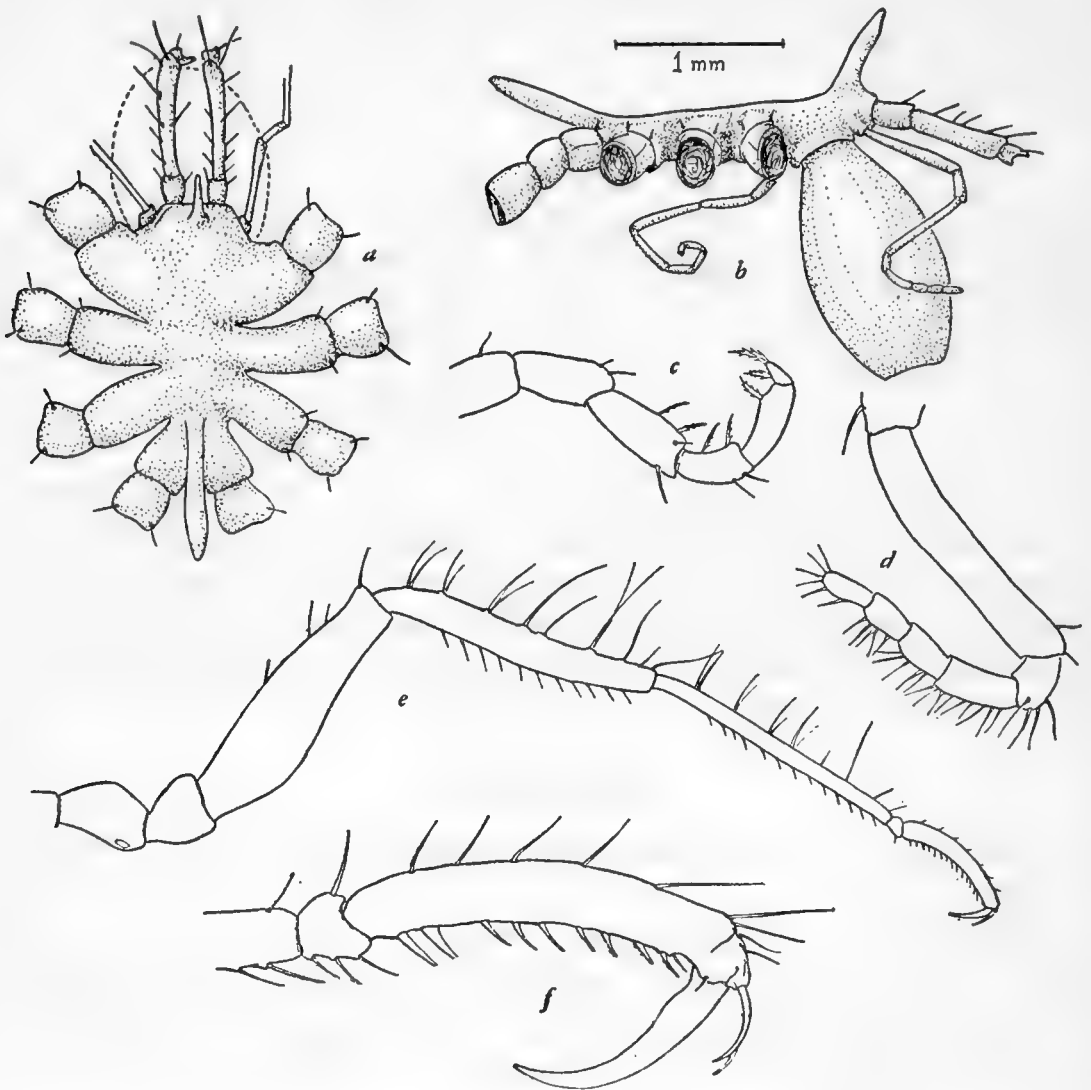


FIGURE 42.—*Ammothella profunda*, new species: *a*, Dorsal view of trunk; *b*, lateral view; *c*, terminal joints of oviger; *d*, palpus; *e*, third leg; *f*, tarsus and propodus.

Palpus slender, recurved, somewhat longer than proboscis, the terminal segments conspicuously spinose on the ventral surfaces.

Abdomen about seven-eighths as long as trunk, reaching at least to the end of the first coxal segments of the last pair of legs.

Third leg slender, with femur with a few spines distally, the first and second tibiae with two dorsal rows of long spines whose length is at least three times the width of the joint, and with shorter spines ventrally. Propodus without a heel but with two large basal spines

and several widely spaced spines along the sole. Terminal claw strongly curved, about half as long as propodus. Auxiliaries about a third as long as the terminal claw.

Oviger 10-jointed, with a few scattered denticulate spines on the terminal segments.

*Measurements.*—As follows:

	Mm.	Third leg:	Mm.
Proboscis.....	1.5	Coxae.....	1.4
Trunk .....	1.75	Femur .....	1.75
Second lateral process, width.....	1.75	First tibia.....	1.9
Abdomen.....	.9	Second tibia.....	1.9
		Tarsus .....	.1
		Propodus .....	.75
		Terminal claw.....	.3

*Remarks.*—Heretofore species of *Ammothella* have been known only from littoral waters, and this deep record establishes a new bathymetric range for the genus. Only one other species, *A. bi-unguiculata*, is known from Japanese waters, and it can be separated easily from this species by the absence of the terminal claw. The locality is off southern Honshu.

#### Genus ASCORHYNCHUS Sars, 1877

Of the six species of this genus known to occur in Japanese waters, five are represented in the collections examined, and the key below is based primarily on the characters of these specimens.

1. Chelifore 2-jointed; extent less than two inches..... 2  
Chelifore 3-jointed; extent two to three inches..... japonicus (p. 292)
2. Trunk, or lateral processes and coxae, with prominent dorsolateral tubercles or projections..... 3  
Without prominent tubercles or coxal processes..... glaberrimus (p. 293)
3. Tarsus more than half as long as propodus..... 4  
Tarsus less than half as long as propodus..... cryptopygius (Ortmann)
4. Abdomen more than half as long as proboscis..... 5  
Abdomen half as long or less than half as long as proboscis.  
auchenicus (p. 291)
5. Fingerlike processes on second coxae almost as long as width of joint.  
ramipes (p. 292)  
Processes on second coxae very short..... glabroides (p. 293)

#### ASCORHYNCHUS AUCHENICUS (Slater)

*Parazetes auchenicus* SLATER, 1879, pp. 281–283.

*Ascorhynchus minutus* HOEK, 1881, pp. 55–57, pl. 6, figs. 10–16.

*Ascorhynchus bicornis* ORTMANN, 1891, pp. 162–163.

*Ascorhynchus minutus* LOMAN, 1908, p. 33.

*Ascorhynchus ramipes* (part) LOMAN, 1911, p. 6.

*Ascorhynchus auchenicus* CALMAN, 1922, pp. 199–203, figs. 1–4.

*Collecting record.*—Albatross station 3707 (1 ovigerous male); 3708 (1 female).

According to Calman's revision, based on Slater's type specimen of *Parazetes auchenicus*, and Hoek's *Challenger* types of *A. minutus*, these specimens represent the same species. Accordingly, its range is from Japanese waters to Port Philip, on the southern coast of Australia. Loman's specimen was taken by the *Siboga* Expedition at station 310 [latitude  $8^{\circ}30'$  S., longitude  $119^{\circ}7.5'$  E., 73 m.]

**ASCORHYNCHUS RAMIPES (Böhm)**

*Gnamptorhynchus ramipes* BÖHM, 1879b, pp. 56-59, fig. 1.

*Ascorhynchus ramipes* ORTMANN, 1891, pp. 161-162, pl. 24, fig. 4.—LOMAN (part), 1911, p. 6.

*Ascorhynchus ramipes* var. *tsingtaoensis* LOU, 1936, pp. 2-19, figs. 2-6, pl. 1.

*Collecting records*.—Nagasaki, Japan (1 male). Tokyo Bay, E. S. Morse, collector (several specimens, including ovigerous males).

Lou's variety *tsingtaoensis* of this species is based on the following differences between his specimens from the China coast and the earlier descriptions of Böhm and Ortmann: The proboscis of *A. ramipes* is half as long as the trunk, whereas in Lou's specimens it is less than half as long, and likewise the abdomen is shorter than the proboscis in the variety instead of equal to it. The variety has a pair of small protuberances behind the base of the chelifores which were not described for the species.

With the exception of a somewhat longer abdomen than Lou's figures, these Japanese specimens agree so closely with his description that I do not believe a separate variety name is tenable. The small tubercles at the base of the chelifores are present, and the proboscis is less than half as long as the trunk.

**ASORHYNCHUS JAPONICUS Ives**

*Ascorhynchus japonicus* IVES, 1892, pp. 219-221.—LOMAN, 1911, p. 5.—OHSHIMA and KISHIDA, 1947, p. 1008, fig. 2859.

*Collecting records*.—Albatross stations 4980 (1 male); 5032 (2 males, 3 females); 5079 (2 males, 1 female); 5082 (3 males, 1 ovigerous; 1 female); 5084 (3 females); 5094 (2 females).

This handsome species is the most easily identified of the Japanese species of *Ascorhynchus*. It bears a superficial resemblance to the large *Ascorhynchus* of the Atlantic, *A. armatus* (Wilson), but it is much coarser in structure than the Atlantic species; the dorsal trunk tubercles are heavier and the proboscis is much stockier and blunter than in *A. armatus*. The collection of an ovigerous male is of interest, inasmuch as ovigerous males of the Atlantic species are unknown. The eggs are small, packed in a dense saclike mass which, in the preserved state, is draped over the oviger.

Apparently this species has an extensive bathymetric range; all previous collections appear to have been made in shallow water, whereas these records indicate a further range from 88 to 918 fathoms. The range of the *Albatross* stations at which this species was collected is from latitude  $34^{\circ}$  to  $44^{\circ}$  N., from southeast of Honshu to northeast of Hokkaido.

ASCORHYNCHUS GLABROIDES Ortmann

*Ascorhynchus glabroides* ORTMAN, 1891, pp. 160–161, pl. 24, fig. 3, *a*, *b*.—LOMAN, 1911, p. 7.

*Collecting record*.—*Albatross* station 4900 (1 male). This locality is west of Kyushu.

This specimen appears to be identifiable with this species; it is separable from the other members of the genus in the collection on the basis of the prominent tubercles on the lateral processes, which are two or three times as tall as those on the median line of the trunk, and the short processes or tubercles on the first coxae. These processes are pointed, about half as long as the width of the coxal joint, and are directed upward at a  $45^{\circ}$  angle. There is also a single small process on the middle of the second coxa. The proboscis is quite pointed, about half as long as the trunk. The abdomen reaches to about the middle of the second coxae of the last pair of legs.

ASCORHYNCHUS GLABERRIMUS Schimkewitsch

*Ascorhynchus glaberrimus* SCHIMKEWITSCH, 1913, pp. 242–244, pl. 3a, figs. 8–14; 1930, pp. 107–110, figs. 23–25.

*Collecting record*.—Nagasaki, Japan (1 ovigerous male, 1 female, 1 juvenile).

Compared with the other species from Japanese waters, *A. glaberrimus* has a bald, unadorned appearance. There are, however, low conical tubercles on the ends of the lateral processes, and small tubercles at the bases of the chelifores. So far, this species is known only from the vicinity of Nagasaki, and no record of its bathymetric distribution is available.

Genus CILUNCULUS Loman, 1908

The principal characters that set this genus off from such closely related genera as *Ammothella* and *Heterofragilia* are the longer second joint of the oviger, the tubular femoral cement gland of the male (which is present in some species of *Ammothella*), and the overhanging dorsal process of the cephalic segment. A very closely related form from Brazil is that described by Mello-Leitão (1946) as *Acanthammothella*, which I have already suggested (1948, p. 262) is a

*Cilunculus*. However, *Acanthammothella* has a short second joint of the oviger and lacks auxiliary claws on the legs, which are present in all the known species of *Cilunculus*. The latter character is not a good generic character, since it does not hold in such genera as *Nymphon* and *Pycnogonum* and in *Ammothella* there is one species, *uniunguiculata* (Dohrn) which lacks auxiliaries, and another, *biunguiculata* (Dohrn) which has auxiliaries but lacks the main terminal claw. The cement glands of *Acanthammothella* are mentioned as "abundant," which indicates that this form does not have the femoral tube of the typical *Cilunculus*. Inasmuch as a great variety of forms of the cement gland, from a row of open pores to an elaborate vesicular process, occurs in *Anoplodactylus* (Hedgpeth, 1948, p. 219), and a tubular gland is present in most species of *Ammothella* but lacking in *A. biunguiculata*, the presence or absence of this structure is at best an incomplete character. Except for the short second joint of the oviger, therefore, Mello-Leitão's *Acanthammothella* cannot be separated from *Cilunculus* and its general form indicates its close relationship to that genus. In the structure of the oviger it resembles *Heterofragilia*, a genus from the Lesser Antilles. It is apparent that those various small ammotheid genera are in need of more thorough study.

CILUNCULUS ARMATUS (Böhm)

FIGURE 43

*Lecythorhynchus armatus* BÖHM, 1879c, pp. 141-142.

*Parazetes pubescens* ORTMANN, 1891, pp. 163-164, pl. 24, figs. 5, a-d.

*Cilunculus armatus* LOMAN, 1911, pp. 9-11, pl. 1, figs. 1-8.

*Collecting records*.—*Albatross* stations 3734 (1 female); 5021 (1 ovigerous male, 1 female); 5037 (1 female).

Loman's figures do not do justice to this quaint little creature and since his paper is not easily accessible I have figured a specimen from *Albatross* station 3734. The processes and tubercles on the trunk and lateral processes are more prominent than would appear from his drawings. The proboscis is prominently egg-shaped, which is the best field mark for separating it from the species of *Ascorhynchus*. The overhanging forward edge of the trunk or cephalic segment seems to be a character of the genus, as is the possession of a prominent femoral gland duct in the male, located in this species about midway on the dorsal surface of that joint. This is evidently a cold-water form, occurring from Sagami Bay to the Sea of Okhotsk.

Genus LECYTHORHYNCHUS Böhm, 1879

Loman (1908, p. 54) appears to have been the first to suggest that this genus belongs in the Ammotheidae.

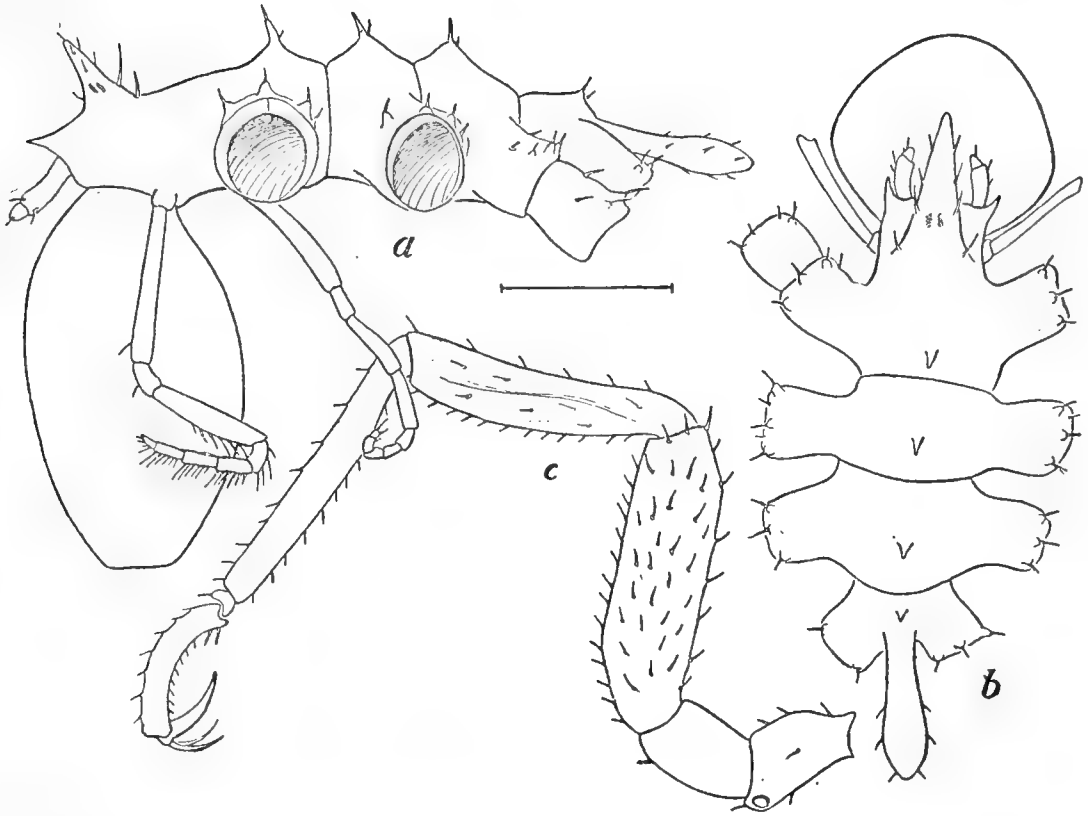


FIGURE 43.—*Cilunculus armatus* (Böhm): *a*, Lateral view; *b*, dorsal view; *c*, leg. All drawings of female specimen, to same scale. (Line equals 1 mm.)

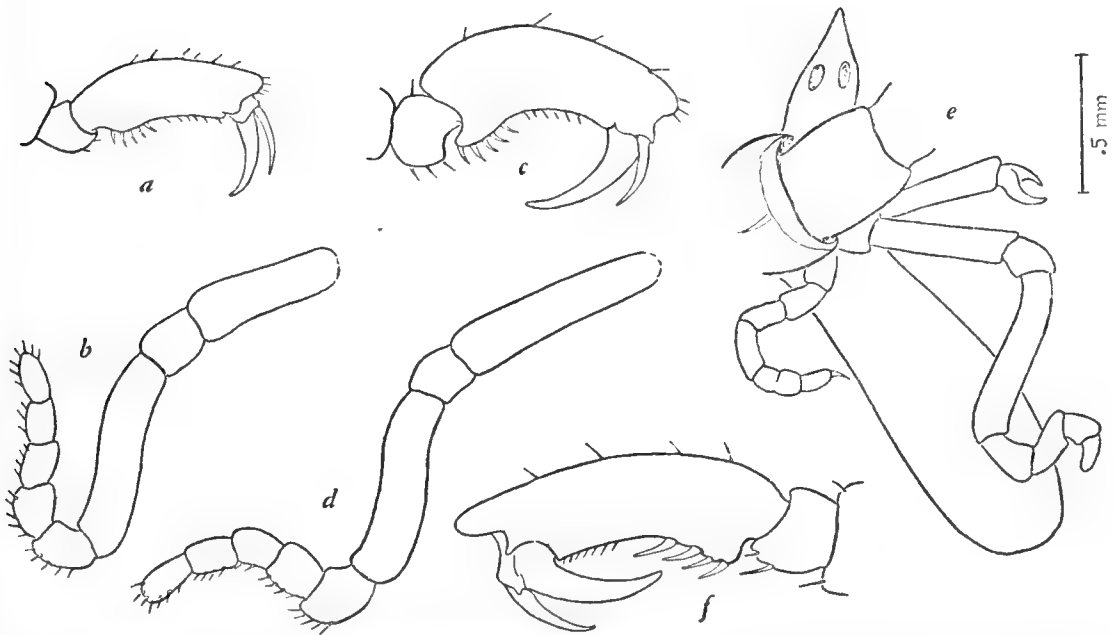


FIGURE 44.—*a, b*, *Lecythorhynchus hilgendorfi* (Böhm): *a*, Tarsus and propodus; *b*, palpus. *c, d*, *L. marginatus* Cole: *c*, Tarsus and propodus; *d*, palpus. *e, f*, *Lecythorhynchus* sp.: *e*, Lateral view of anterior region; *f*, tarsus and propodus.

## LECYTHORHYNCHUS HILGENDORFI (Böhm)

FIGURE 44, a, b

*Corniger hilgendorfi* BÖHM, 1879a, pp. 187-189, pl. 2, figs. 3-3d.

*Lecythorhynchus hilgendorfi* BÖHM, 1879c, pp. 140-141.—LOMAN, 1911, pp. 8-9, pl. 2, figs. 28-29.—OHSHIMA and KISHIDA, 1947, p. 1009, fig. 2864.

*Collecting records*.—Sarawato Chochi, July 20-23, 1929, A. S. Pearse, collector; 3 specimens. Takami, near Chochi, July 23, 1929, A. S. Pearse, collector; several specimens. Peiyushan Island; several specimens.

Three species have been proposed for this genus: *L. hilgendorfi* from Japan, *L. marginatus* Cole (1904) from California, and *L. ovatus* Hilton (1942d) from Hawaii. While it is impossible to pass final judgment on Hilton's species, it appears to be very closely related to the California form (which is found on the Pacific coast as far south as Cerro Island, Baja California) and the principal character, the serrate palpus, is possibly an illusory one, as I have noticed that specimens of *L. marginatus* when inspected *in vitreo* seem to have this character, but when mounted on a slide, appear as in figure 44, d. Certainly *L. hilgendorfi* and *L. marginatus* are closely related, but they can be distinguished on the basis of the structure of the palpus. In *L. marginatus* the sixth joint is inserted at a distinct angle from the fifth joint, whereas in *L. hilgendorfi* this is not so pronounced (fig. 44, a and c) although Ohshima's (1927d, pl. 7, fig. 5) figure indicates that this condition is present in some specimens. The auxiliary claws are much longer in the Japanese species, and the heel of the propodus is not as prominent as in *L. marginatus*. This is probably a littoral or subtidal species of central Japan. These records are from the eastern coast of Honshu.

## ? LECYTHORHYNCHUS species

FIGURE 44, e-f

*Collecting record*.—Albatross station 3730 (1 immature female).

Although considerably larger than the specimens of *L. hilgendorfi*, this appears to be an immature specimen, to judge from the undeveloped appearance of the oviger and the chelate chelifores. The conformation of the palpus and propodus of this specimen suggest *Lecythorhynchus*, but its generic affiliation is none too certain.

## Family TANYSTYLIDAE Schimkewitsch, 1913

## Genus TANYSTYLUM Miers, 1879

Among the notes that Prof. Hiroshi Ohshima kindly turned over to me are drawings and measurements of an undescribed species of *Tanystylum*. Inasmuch as no species of this genus has been described



from Japanese waters, the following description, based on these notes, and adopting Ohshima's manuscript name, is submitted. I wish to thank Professor Ohshima for the free use of these notes in order to make a valuable addition to our knowledge of the distribution of this genus.

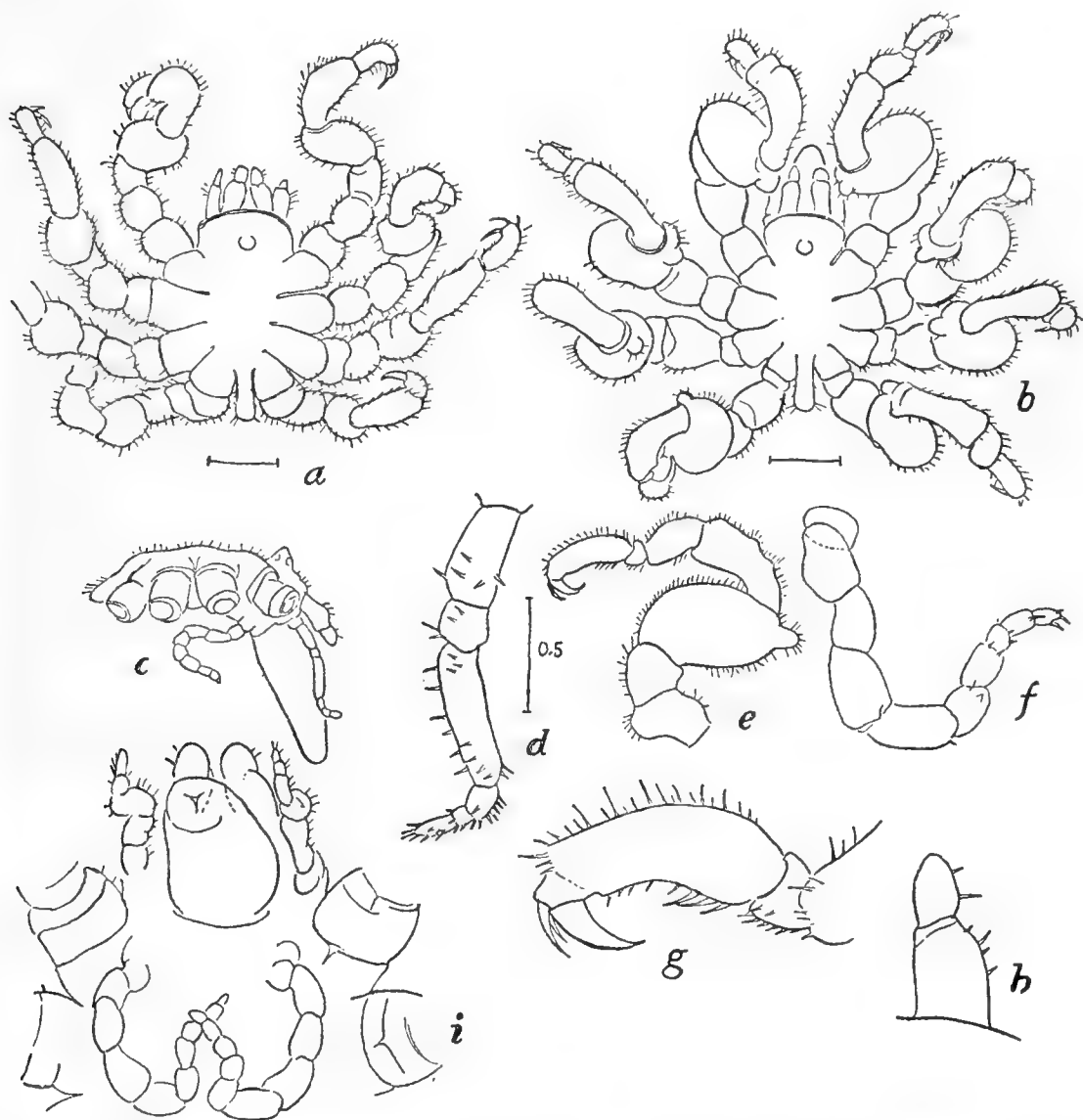


FIGURE 45.—*Tanystylum anthomasthi*, new species: *a*, Dorsal view of specimen 1; *b*, dorsal view of specimen 2; *c*, lateral view; *d*, palpus; *e*, second leg; *f*, oviger; *g*, tarsus and propodus; *h*, chelifore, ventral view of anterior half of body. (Lines under *a* and *b* equal 1 mm.)

**TANYSTYLUM ANTHOMASTHI, new species**

**FIGURE 45**

*Collecting records.*—Daikoku Jima, mouth of Akkeshi Bay, Hokkaido, July 10, 1940, attached to *Anthomasthus*, Dr. Okuda-Shirō, collector, 2 specimens (both apparently females).

*Description.*—Trunk circular in outline, the lateral processes contiguous but not coalesced. The cephalic segment is slightly prolonged

anteriorly. There are no dorsal tubercles or processes. Both trunk and legs are covered with fine hairlike setae. Eye tubercle about as broad at base as high, roundly conical.

Proboscis slightly shorter than trunk, tapering to a blunt rounded tip, directed downward.

Chelifore short, basal segment as wide as long. Second segment about half as long as basal, rounded. A few spines on the outer surface of both joints.

Palpus 7-jointed, slender, almost as long as proboscis; the joints armed with short spines. The fourth joint is slightly longer than the second.

Abdomen about twice as long as last lateral process, horizontal or directed slightly ventrad.

Leg: Coxae subequal, or second slightly longer than the other two. Femur about as long as coxae together, swollen, with a prominent rounded knob on the dorsodistal end. First tibia two-thirds as long as femur, with low knobs on the dorsal surface bearing short spines or setae. Second tibia half as long as first, also with low knobs and setae. Tarsus very short, triangular in lateral view. Propodus rather stout, slightly curved, without heel but bearing three prominent basal spines. Terminal claw heavy, curved, half as long as propodus. Auxiliaries little more than half as long as terminal claw.

Oviger: First joint shorter than broad, second and third subequal, fourth slightly longer. Joints 7-10 diminishing in size, armed with pairs of short spines on the ventrodistal margins.

*Measurements* (of "specimen 2"), as follows:

	<i>Mm.</i>	Third leg:	<i>Mm.</i>
Proboscis-----	1.9	Second coxa-----	0.7
Trunk-----	2.0	Third coxa-----	.7
Chelifore-----	.35	Femur-----	1.7
Oviger-----	2.5	First tibia-----	1.3
Abdomen-----	.8	Second tibia-----	1.0
Palpus-----	1.38	Tarsus-----	.25
		Propodus-----	.8
		Terminal claw-----	.4
		Auxiliary claw-----	.25

*Remarks.*—This species resembles *T. orbiculare* Wilson in lacking tubercles on the trunk and coxae, but it is evidently distinct from other species in the genus because of its coating of fine hairlike setae.

## Family COLOSSENDEIDAE Hoek, 1881

### Genus COLOSSENDEIS Jarzynsky, 1870

#### COLOSSENDEIS ANGUSTA Sars

*Colossendeis angusta* Sars, 1877, pp. 268-269.—LOMAN, 1908, p. 22.—HILTON, 1943b, p. 3.

*Collecting records.*—*Albatross* stations 4969 (2 specimens); 4975 (1 specimen); 4980 (1 specimen); 5043 (3 specimens); 5050 (4 specimens); 5083 (3 specimens).

This well-known species is widely distributed throughout the colder waters of the world, north and south. There is no significant difference between these Japanese specimens and those taken from New England waters on the early cruises of the *Albatross*, with which they have been compared. These are the first records of this species in Japanese waters, although Hilton identifies several specimens from the eastern North Pacific. The stations at which this species was collected range from latitude  $33^{\circ}23'$  N. to  $42^{\circ}10'$  N., all off the eastern shores of the archipelago.

#### COLOSSENDEIS COLOSSEA Wilson

*Colossendeis colossea* WILSON, 1881, pp. 244–246, pl. 1, fig. 1; pl. 3, figs. 5–7.—

OHSHIMA, 1936, pp. 866–867.—OHSHIMA and KISHIDA, 1947, p. 1009, fig. 2863.

*Colossendeis gigas* OHSHIMA and KISHIDA, 1947, p. 1009, fig. 2862.

*Collecting records.*—*Albatross* stations 4974 (1 specimen); 5082 (1 specimen).

Comparison of these specimens with several taken from the Western Atlantic (the type region) shows no significant differences and confirms the suspicion of previous workers that this is an ubiquitous deep-water species. Both these records are southeast of Honshu.

#### COLOSSENDEIS MACERRIMA Wilson

*Colossendeis macerrima* WILSON, 1881, pp. 246–247, pl. 1, fig. 2; pl. 4, figs. 9–12; pl. 5, fig. 32.—CALMAN, 1923, pp. 267–268.—OHSHIMA, 1936, p. 867.

*Collecting locality.*—*Albatross* station 5083 (1 male?).

One small recently moulted specimen of this species is represented in the collection. The proboscis measures 1.75 mm., and the specimen is about half the size of an average full-grown example from the North Atlantic. It appears to be a male. Like *C. colossea*, this is evidently a cosmopolitan deep-water species. This locality is southeast of Honshu.

#### COLOSSENDEIS JAPONICA Hoek

FIGURE 46, *a-d*

*Colossendeis japonica* HOEK, 1898, pp. 295–296, pl. 2, fig. 3.

*Collecting record.*—*Albatross* stations 4912 (3 specimens); 4915 (1 specimen).

This is the second record for this species, which was first collected by the *Challenger* at station 237, latitude  $34^{\circ}37'$  N, longitude  $140^{\circ}32'$  E, 1,875 fathoms. In appearance it is superficially like *C. angusta*, but it is readily separable from that species by the short second joint of the palpus and by the combination of long tarsus and short terminal claw. The proboscis in these specimens is somewhat longer than the

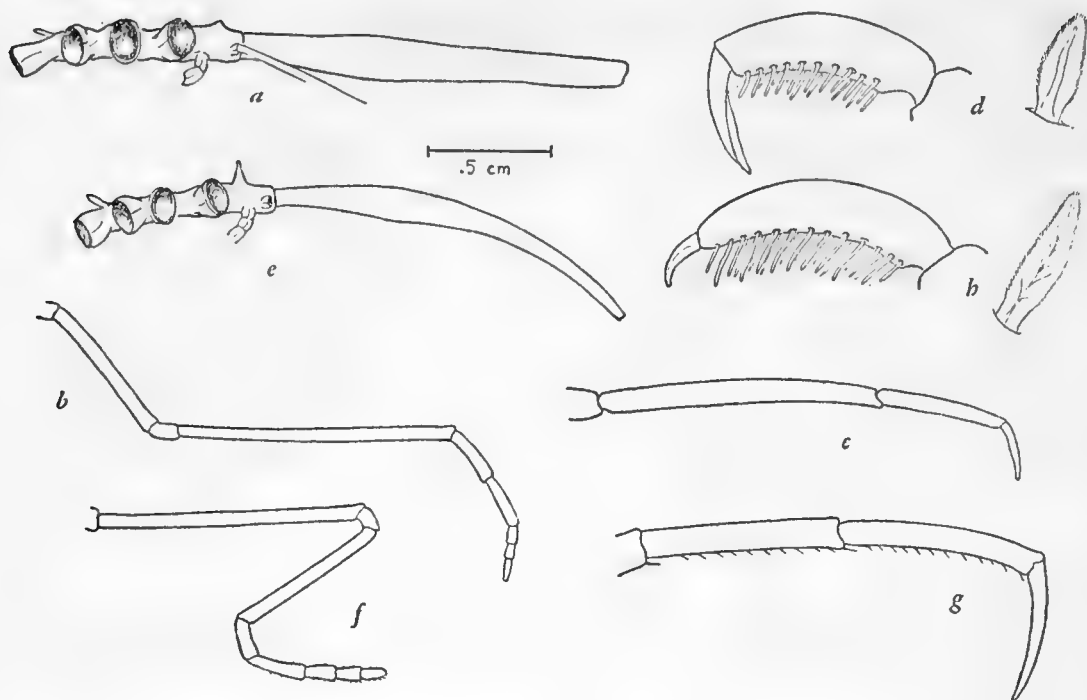


FIGURE 46.—*a-d*, *Colossendeis japonica* Hoek: *a*, Lateral view; *b*, palp; *c*, tarsus and propodus; *d*, terminal joint and spine of oviger. *e-h*, *C. nasuta*, new species: *e*, Lateral view of holotype; *f*, palp; *g*, tarsus and propodus; *h*, terminal joint and spine of oviger.

specimen figured by Hoek and the tarsus is more than twice as long as the propodus instead of about one-and-one-half times as long; in one specimen (fig. 47, *a*) the proboscis is 16 mm. long and the trunk is 9 mm. long. Both these stations are southwest of Kyushu.

#### COLOSSENDEIS DOFLEINI Loman

##### FIGURE 47, *a-d*

*Colossendeis dofleini* LOMAN, 1911, pp. 4-5, pl. 1, figs. 6-13.—OHSHIMA, 1936, p. 867.

*Collecting records*.—*Albatross* stations 3331 (1 specimen); 4803 (1 specimen); 4804 (1 female, 1 juvenile); 5029 (1 specimen); 5079 (1 female).

This appears to be a somewhat variable species; the proboscis of the specimen from *Albatross* station 5029 is not so conspicuously dilated as those of the other specimens, but it is otherwise inseparable from them. The terminal joints of the palpus are somewhat shorter than figured by Loman.

*C. dofleini* is evidently a widely distributed species in the North Pacific. Station 5079 is south of Honshu; all the others are east of the Kuriles.

## COLOSSENDEIS CHITINOSA Hilton

FIGURE 47, e-h

*Colossendeis chitinos* HILTON, 1943b, p. 4.

*Collecting records*.—*Albatross* stations 3703 (1 specimen); 4982 (6 specimens).

Sagami Bay, 1 specimen.

Identification of this species has been confirmed by examination of the type material, from which it differs in the possession of a somewhat longer terminal claw. As the species has not been described or figured, a description, based on the above specimens, follows:

Trunk completely segmented, with ringlike swellings at the distal ends of the segments. This ring is projected into a sharply pointed tubercle dorsally. The eye tubercle is about twice as tall as the dorsal trunk tubercles, sharply pointed with the point projected forward. The eyes are heavily pigmented, located in the basal third of the tubercle. Although Hilton describes the eyes as "being at different levels" they are not conspicuously so; it is the forward slant of the eye tubercle which gives this impression.

Abdomen very small, bluntly conical and almost ventral in location.

Proboscis longer than trunk, dilated, curved downward as in *C. dofleini*.

Palpus second joint curved, about one and one-third as long as fourth. Joints 7 to 9 long, slender, subequal, sixth slightly shorter than seventh.

Third leg coxae subequal, about as broad as long. Femur and second tibia subequal, first tibia about a third longer than femur. Tarsus slightly longer than propodus, terminal claw almost as long as propodus. The sole of both tarsal joints bears a closely set row of fine, short spines.

Oviger somewhat short for a member of this genus. Second and fourth joints subequal. Terminal joints subequal, with several rows of spines which do not appear to be denticulated. On the last segment there is a large spine opposing the terminal claw, forming a subchelate structure.

*Measurements*.—Proboscis, 6 mm.; trunk 3.5 mm.; third leg, ca. 25 mm.

*Remarks*.—This species is superficially close to *C. dofleini*, but is about two-thirds as large, with much slenderer legs and terminal claw. *Colossendeis dofleini* has no spines on the tarsal joints. In the structure of the terminal segment of the oviger it resembles *C. californica* Hedgpeth (1939), but differs from that species in the structure of the eye tubercle and shorter terminal claw.

*C. chitinos* ranges from Sagami Bay to the Aleutians.

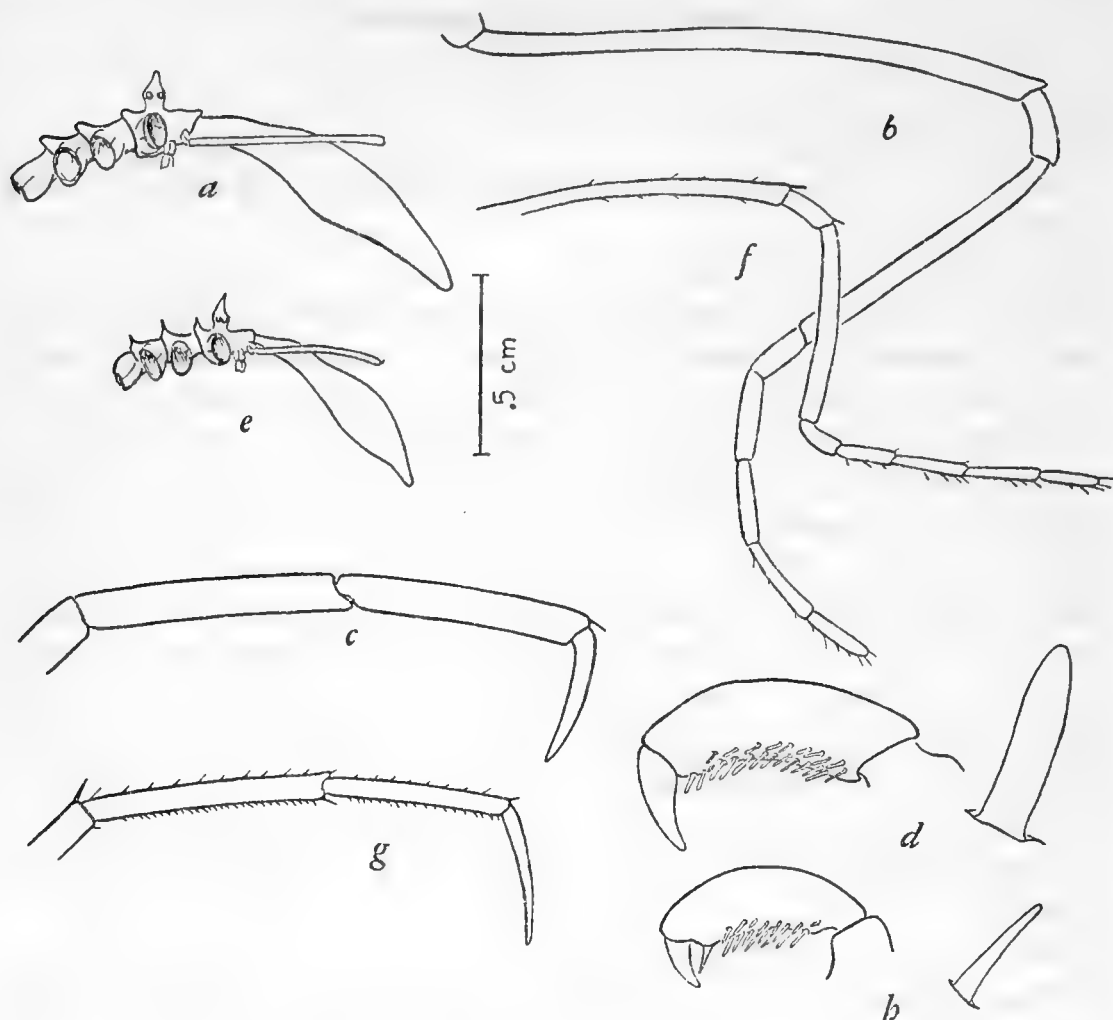


FIGURE 47.—*a-d*, *Colossendeis dofleini* Loman: *a*, Lateral view; *b*, palpus; *c*, tarsus and propodus; *d*, terminal joint and spine of oviger. *e-h*, *C. chitinsa* Hilton: *e*, Lateral view; *f*, palpus; *g*, tarsus and propodus; *h*, terminal joint and spine of oviger.

**COLOSSENDEIS NASUTA, new species**

FIGURE 46, *e-h*

*Holotype*.—U.S.N.M. No. 80548.

*Collecting record*.—Albatross station 4912, latitude  $31^{\circ}39'40''$  N., longitude  $129^{\circ}40'$  E., 391 fathoms, August 12, 1906.

*Description*.—Trunk elongated, unsegmented, lateral processes separated by about their own diameter. Eye tubercle conical, sharply pointed, eyes not apparent. The trunk and legs are without any tubercles or prominent spines.

Abdomen papilliform, about as long as first coxae of last legs.

Proboscis about one and one-half times as long as trunk, slender, curved gracefully downward. Its greatest diameter occurs in the proximal third, and it tapers gradually to about half that diameter at the tip.

Palpus somewhat longer than proboscis, the terminal segments diminishing in size. The second segment is about twice as long as the fourth, and the third half as long as the fifth.

Third leg: Coxae subequal, about as broad as long. Femur and first tibia subequal, second tibia somewhat shorter. Tarsus and propodus equal, terminal claw two-thirds as long as propodus. The sole of both tarsal joints bears a row of small, well-separated spines.

Oviger: Second and fourth segments subequal, third about a third as long. Terminal segments subequal, tightly coiled, bearing several rows of rather long compound spines. The compound spines are very finely denticulate. The last joint is slender and tapering, with a terminal claw that is about as long as the width of the segment itself.

*Measurements.*—As follows:

	<i>Mm.</i>	Third leg:	<i>Mm.</i>
Proboscis	14.0	Coxae	3.5
Trunk	8.0	Femur	19.0
Second lateral process, width	3.25	First tibia	20.0
Abdomen	1.75	Second tibia	13.5
Palpus	ca. 19.5	Tarsus	3.0
		Propodus	3.0
		Terminal claw	2.0

*Remarks.*—The combination of a long, slender, curved proboscis and a very long terminal claw separates this species from other members of the genus. The specimen appears to be a male. It was collected at the same station as *C. japonica*, southwest of Honshu.

## Family PYCNOGONIDAE Wilson, 1878

### Genus PYCNOGONUM Brünnich, 1764

#### PYCNOGONUM TENUE Slater

FIGURES 48, b; 50, c

*Pycnogonum littorale* var. *tenue* SLATER, 1879, pp. 281–283.

*Pycnogonum tenue* OHSHIMA, 1936, p. 867.—OHSHIMA and KISHIDA, 1947, p. 1010, fig. 2865.

*Collecting records.*—*Albatross* stations 3707 (1 female); 3708 (2 females); 3716 (1 female); 4893 (1 male); 4895 (1 male); 4933 (1 female).

This species has not been previously figured except in generally inaccessible Japanese works and the original description leaves several important details undiscussed. Although it does superficially resemble *P. littorale* in the shape of its proboscis, the dorsal trunk tubercles are quite high, sometimes prolonged to points, and the integument is lightly reticulated as well as granulated. In some specimens the reticulations are not apparent; in others they occur together with granulations. The oviger is 9-jointed, exclusive of the terminal claw. The genital pores are on the second coxae. In the female they are dorsal whereas in the male they are ventral, on a low but well-developed conical tubercle. I could find them only on the last pair of legs.

All these records are west of Kyushu.



## PYCNOGONUM UNGELLATUM Loman

FIGURE 48, c; 50, e-g

*Pycnogonum ungelatum* LOMAN, 1911, pp. 7-8, pl. 2, figs. 25-27.—OHSHIMA, 1937, p. 868.

*Collecting records.*—*Albatross* stations 4803 (1 female); 4804 (1 male, 1 female).

Loman's description of this species, based on an immature specimen, is inadequate. The oviger is 9-jointed instead of 8-jointed and the legs are much shorter and thicker than indicated in his figure. The proboscis is somewhat variable. In the specimen I have chosen for illustration it is barrel shaped, as in Loman's figure. The abdomen is squarish at the tip. *P. ungelatum* is apparently related to *P. stearnsi* Ives, but it is without the dorsal trunk tubercles of that species. The genital pores are on the ventral surface of the last two pairs of coxae.

*Measurements* (of apparently mature specimens).—As follows:

Male, station 4803		Female, station 4804	
	Mm.		Mm.
Proboscis .....	2.5	Proboscis .....	3.0
Trunk .....	6.0	Trunk .....	7.0
Width, second lateral process---	3.75	Width, second lateral process---	4.0
Abdomen .....	1.5	Abdomen .....	1.5

These two stations are in the Sea of Okhotsk, east of southern Sakhalin.

## PYCNOGONUM BENOKIANUM Ohshima

FIGURE 49

*Pycnogonum benokianum* OHSHIMA, 1935a, pp. 137-139.—OHSHIMA and KISHIDA, 1947, p. 1010, fig. 2866.

Although this species is described from specimens collected from Okinawa and is not represented in any collections available to me, it seems appropriate to publish a translation of the Japanese description, which is unaccompanied by any figures or synopsis in a European language. While a figure has been published in the "Illustrated Encyclopedia of the Fauna of Japan," this work is not generally available, and I am able to provide figures from Professor Ohshima's notes. The description that follows is based on a literal translation prepared by Dr. Masui Kodani, together with notes supplied by Professor Ohshima, and I wish to thank Dr. Kodani for his generous assistance in this and several other details connected with the Japanese language. I am especially indebted to Professor Ohshima for supplying the additional notes and drawings. Items in brackets are my own comments and additions.

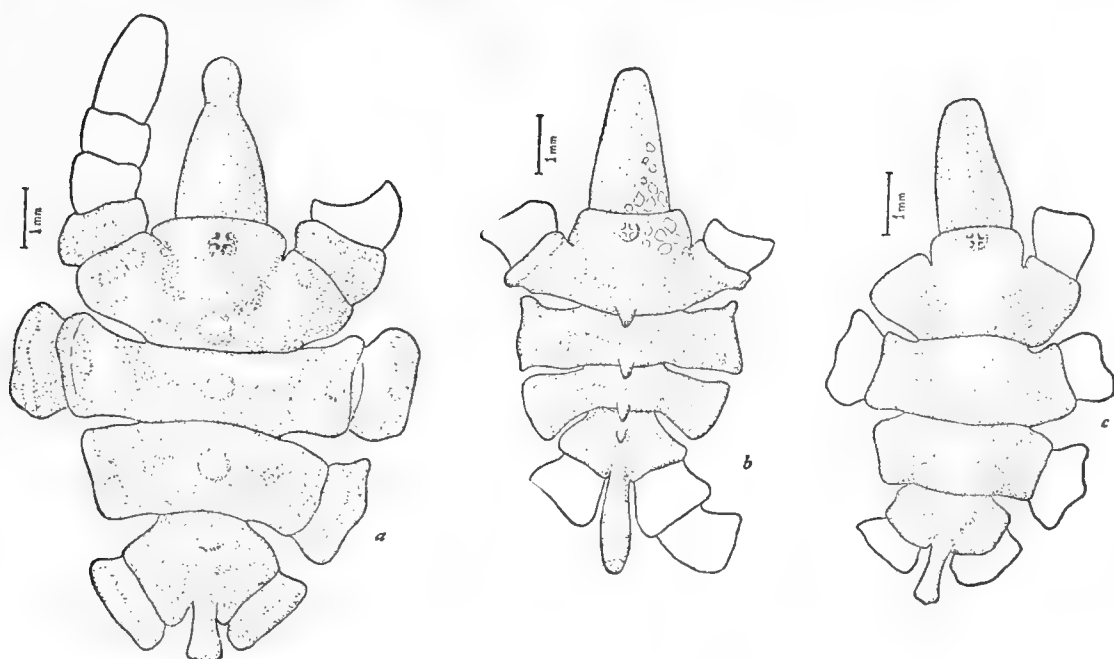


FIGURE 48.—*a*, *Pycnogonum buticulosum*, new species; *b*, *P. tenue* Slater; *c*, *P. ungellatum* Loman.

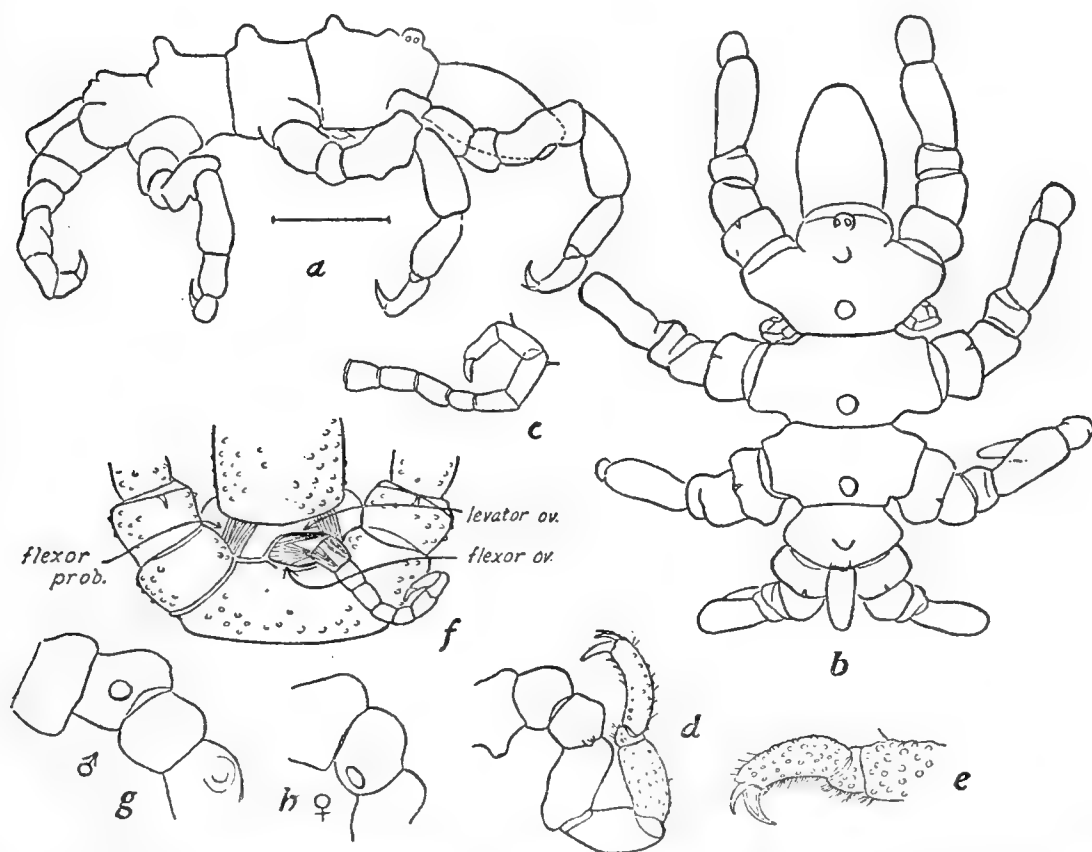


FIGURE 49.—*Pycnogonum benokianum* Ohshima: *a*, Lateral view; *b*, dorsal view; *c*, oviger; *d*, leg; *e*, tarsus and propodus; *f*, view of abnormal specimen, showing location and musculature of single oviger; *g*, male genital pore; *h*, female genital pore.

*Type locality*.—Benoki, Okinawa islands. Collected by Shimoto Toma, between January and March 1932.

*Description*.—Trunk fat, knobby. Integument granular, the granulations coarse, on elevated portions of the trunk. Lateral processes large, nearly as long as the length of the trunk segment, well separated. First trunk segment somewhat rhombic, two-thirds as long as wide. Eye tubercle near anterior margin, low. On the posterior edge of each trunk segment there is a rounded dorsal tubercle.

Proboscis large, slightly more than one-third as long as trunk, basal half cylindrical, distal half bluntly conical.

Abdomen cylindrical, shorter than length of fourth trunk segment.

Oviger 8-jointed, with a terminal claw. Last two segments bearing spines near their outer edge.

Third leg: First coxa almost as large as lateral process, with a notch on the distal posterior part. Second and third coxae diminishing in size. Femur longer than either tibia, with swellings on the inner basal and dorsodistal regions. There are short spines toward the distal end of the femur and first tibia. On the distal ventral margin of the second tibia, and the sole of the tarsus and propodus, is a row of short spines. Terminal claw slightly curved, about half as long as propodus, with small, deciduous auxiliaries. Genital pore on ventral surface of second coxae of last two pairs of legs in both sexes. Eggs about 0.07 mm. in diameter.

*Measurements*.—As follows:

	Mm.	Second leg:	Mm.
Proboscis.....	1.25	Coxae.....	1.2
Length first trunk segment.....	.87	Femur.....	.75
Length last trunk segment.....	.7	First tibia.....	.7
Abdomen.....	.6	Second tibia.....	.6
Total length trunk.....	2.82	Tarsus.....	.12
		Propodus.....	.5
		Terminal claw.....	.2
		Total length leg.....	3.97

*Remarks*.—This new species resembles very closely *P. pusillum* Dohrn, which occurs in the Bay of Naples and is characterized by the granular integument and the presence of auxiliary claws. The one distinct difference is that the genital opening occurs on the dorsal side in *P. pusillum*, whereas in this species it is on the ventral side. No observations have been made of the male of Dohrn's species. Bouvier's statement that there are no tubercles on the median dorsal line of the trunk in *P. pusillum* seems to be an error made by him in reading Dohrn's original description. *P. ungelatum* Loman, which occurs along the coast of Sagami [immediately south of Tokyo Bay], closely resembles *P. benokianum*. [At this point Ohshima's description dis-

cusses the difference in proportions of the joints of the oviger of *P. ungelatum*, based on Loman's figures, which are inaccurate, since the basal joint was overlooked by Loman.]. *P. tenue* (Slater), *P. stearnsi* Cole [sic], both occurring in Japanese waters, *P. crassirostre* Sars from the North Atlantic, and *P. magellanicum* Hoek are all similar to the new species in body shape but lack auxiliary claws, and in this respect differ distinctly from it.

According to Mr. Toma [the collector] this species is attached to a sea anemone which occupies concavities of rock on shallow bottom. Occasionally three sea spiders are found attached to a single host. In the preserved specimen sent to me by the collector I found one hooked to the outer body wall of the host, while four more were enclosed in the gastrovascular cavity. In the literature there is only one species which is known to live attached to sea anemones, *P. littorale* (Ström), occurring commonly in northern Europe. [*P. stearnsi* Ives is reported in association with the large green California coastal anemone *Cribrina xanthogrammica* by Johnson and Snook, 1927, p. 409, Hilton, 1934, Ricketts and Calvin, 1939, p. 54, Hedgpeth, 1941, p. 254, and *P. rickettsi* Schmitt is reported in association with *Metridium* by Schmitt, 1934, *vide* Ricketts.] The earliest record is that of Milne Edwards, who found it on *Cynthia* and fish (divers poissons). E. B. Wilson wrote that it is perhaps parasitic on *Bolocera tuediae*, a sea anemone, because it is often found attached to the lower side. Also G. O. Sars (1891) wrote that it is firmly hooked to *Tealia digitata* and *T. crassicornis* but that it could not be decided whether or not it fed on them. Recent information is scarce but Prell (1911) stated that it [*P. littorale*] is often attached to *Urticina* (*Tealia*) *crassicornis*, and Meisenheimer (1925) found it on *Actiniloba* (*Metridium*) *dianthus* and stated that it absorbs the body fluid through the proboscis, which is buried in the body of the host. According to Arndt (1913) it lives on *Milne-Edwardsia loweni* and according to Cuénot (1921) it also lives on *Cynthia*. Prell observed it very closely and wrote that it is attached not only on four different kinds of sea anemone in an aquarium but also on *Lucernaria* (a jellyfish) and *Cucumaria frondosa*. Dogiel (1913) supplemented this observation while studying its development and stated that only the adult is found attached to the sea anemone and that the younger stages are found only [?] in *Clava multicornis*.

I have named our new species after the place where it was collected. Its mode of living is not yet fully known. It is rather rare that two very similar species of sea spider live so very far apart and at very different latitudes.

## PYCNOGONUM BUTICULOSUM, new species

FIGURE 48, *a*; FIGURE 50, *a*, *b*

*Types*.—Holotype (male): U.S.N.M. No. 80571, *Albatross* shore trip, June 23, 1906, Milne Bay, Simushiru.

Paratypes (4 males, 2 females): Same locality.

*Description*.—Trunk fat, compact, and broad. Lateral processes narrowly separated. The posterior dorsal margin of the first three

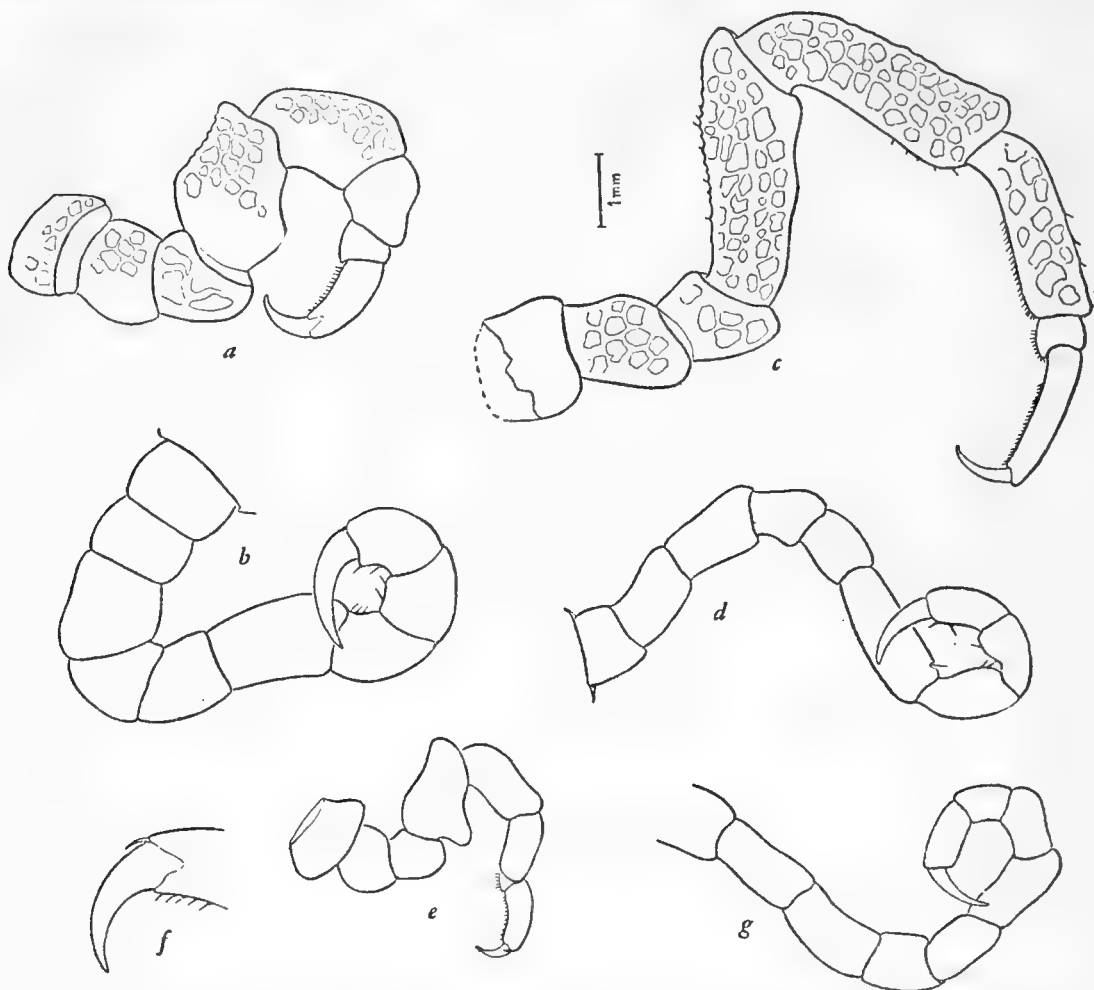


FIGURE 50.—*a*, *b*, *Pycnogonum buticulosum*, new species: *a*, Third leg; *b*, oviger. *c*, *d*, *P. tenue* Slater: *c*, Third leg; *d*, oviger. *e*–*g*, *P. ungelatum* Loman: *e*, Third leg; *f*, detail of terminal and auxiliary claws; *g*, oviger.

trunk segments is raised in a ridge, at the center of which is a prominent rounded tubercle, and there is also a ridge on the dorsodistal margin of the lateral processes. There is a smaller tubercle on the last trunk segment, without such a prominent ridge. The eye tubercle is rounded, about as high as the dorsal trunk tubercles, with prominent eyes. Integument granular, in some specimens also lightly reticulated.

Proboscis slightly more than half as long as trunk, nipple- or bottle-shaped.

Abdomen short, clavate or square tipped, reaching to the distal margin of the first coxae of the last legs.

Third leg short and knobby, with reticulations in some specimens. Terminal claw more than half as long as the propodus, without auxiliaries. Sole of propodus armed with a row of fine spines. Genital pore on dorsal surface of second coxae of last pair of legs of female, possibly the last two pairs; I could not find them on the male.

Oviger 9-joined, the segments short and thick. The claw is somewhat longer than the terminal segment.

*Measurements.*—As follows:

	<i>Holo- type, ♂ Mm.</i>	<i>Para- type, ♀ Mm.</i>	<i>Holotype</i>	<i>Mm.</i>
Proboscis-----	4.0	6.0	Third leg:	
Trunk-----	7.0	9.5	Coxae-----	2.0
Second lateral process,			Femur-----	2.0
width-----	5.0	6.5	First tibia-----	1.5
Abdomen-----	1.5	2.0	Second tibia-----	1.0
			Tarsus-----	.5
			Propodus-----	1.25
			Terminal claw-----	.75

*Remarks.*—This species bears a superficial resemblance to *P. stearnsi* Ives, which is reported from the North Kuriles by Ohshima (1933d), but it is readily separated from that species by the peculiar shape of the proboscis. Simushiru is one of the islands of the Kurile group.

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## APPENDIX

Detailed information relative to *Albatross* stations will be found in Appendix Table 1.

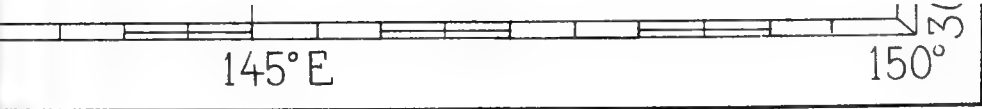
Localities at which pycnogonids have been collected in Siberian waters, taken from Losina-Losinsky (1933) are tabulated in Appendix Table 2. In the latter, English place names are taken from Hydrographic Office Publication No. 122 (1932), "Sailing Directions for Siberia and Chosen." Several localities falling within the area of the station chart have been omitted: Askold Island, Rimsky-Korsakoff Island, Furugelma Island, Naumova Island, and Srednyaya Bay. These are all in the vicinity of Peter the Great Bay. Two localities are north of 50°: Kastri Bay (latitude 51°30' N., longitude 140°53' E.) and Kazakevicha Bay (slightly north of 50°, near longitude 142° E.).

I have retained the specific and subspecific names of the Russian text to facilitate reference to it although some of the subspecific names must be changed as Marcus (1940, pp. 128-129) has suggested. Thus *Achelia echinata orientalis* should be *A. echinata nasuta*; *A. gracilipes borealis* should be *A. gracilipes tatarica*; and *A. borealis japonica* should be *A. borealis nipponica*.

There appear to be typographical errors in some of the dates or station numbers, and probably in some of the station positions.

## ABBREVIATIONS USED IN THE TABLES

bk. black	g. gravel	rd. red
br. brown	glob. globigerina	rky. rocky
brk. broken	gn. green	s. sand
co. coral	gy. gray	sa. sabulous (sandy)
crs. coarse	m. mud	sh. shells
dk. dark	oz. ooze	sp. specks
fn. fine	p. pebbles	st. stones
for. Foraminifera	r. rock	vol. volcanic



145° E

150° E



at which pycnogonids were taken  
in Japanese waters, 1906.  
(INSET: STATIONS FOR 1900)

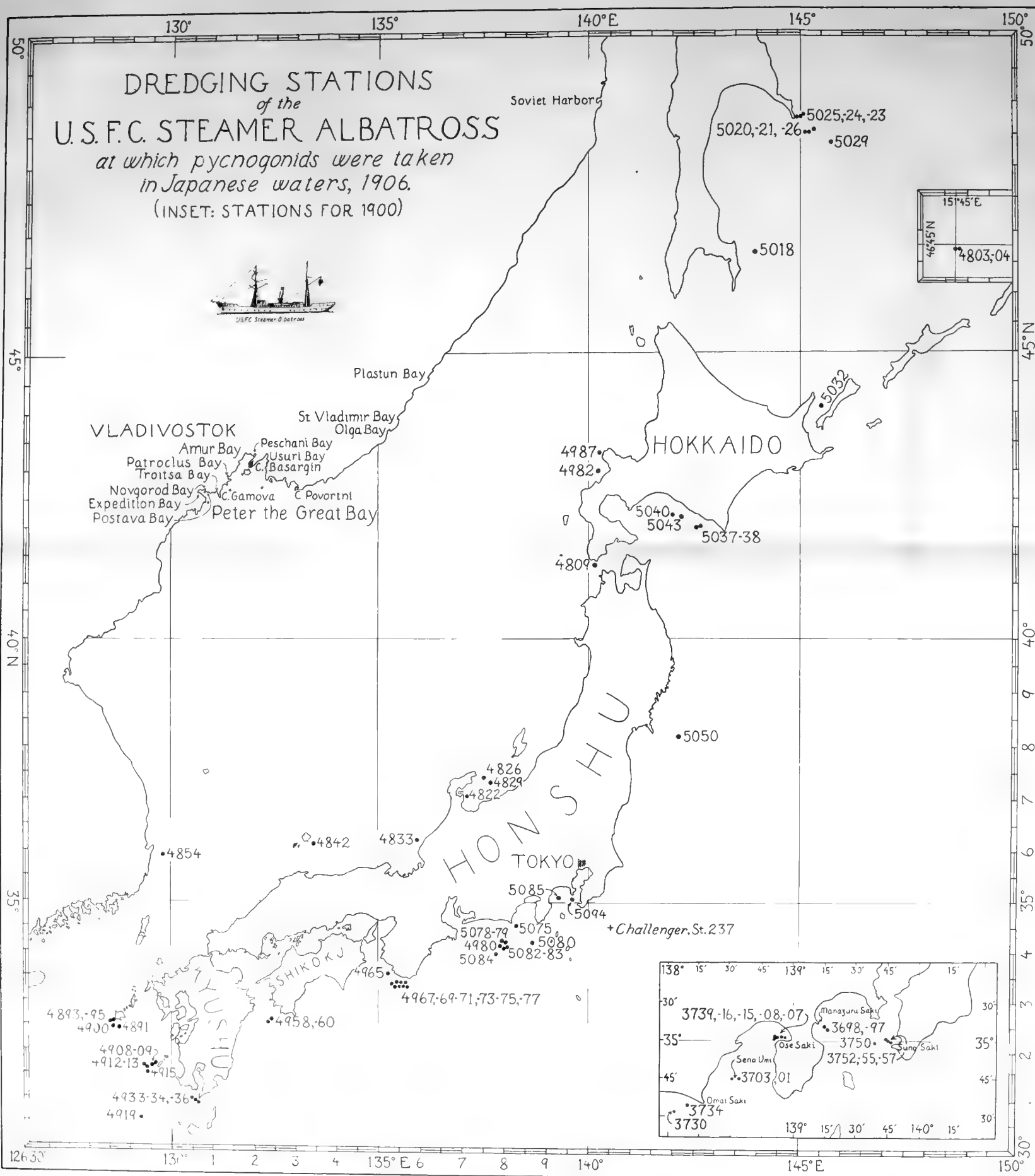


FIGURE 51.—Stations which pycnogonids were collected by the Albatross, 1900 and 1906.





## APPENDIX TABLE 1

LIST OF STATIONS AT WHICH PYCNOGONIDS WERE COLLECTED BY THE ALBATROSS, 1900 AND 1906

Station No.	Date	Locality	Depth	Temp. °F.	Type of bottom	Species of pycnogonids
	1900	Off Honshu	Fathoms			
3697	May 5	Manazuru Zaki, N, 26°; W, 6.0 mi.	120-265	-----	gy. m., vol.s.	<i>Nymphon kodanii</i> .
3698	May 5	Manazuru Zaki, N, 8°; W, 4.5 mi.	150	-----	gn.m., s.-----	<i>Nymphon japonicum</i> , <i>kodanii</i> .
3701	May 7	Seno Umi, N, 10°, W, 2.3 mi.	41-73	-----	vol.s., g.-----	<i>Nymphon japonicum</i> .
3703	May 7	Seno Umi, N, 16°; E, 5½ mi.	31	-----	vol.s., g.-----	<i>Colossendeis chitinoza</i> , <i>Anoplodactylus gestiens</i> .
3707	May 8	Ose Saki, S, 53°; W, 2.5 mi.	63-70	-----	vol.s., a., g.-----	<i>Ascorhynchus auchenicus</i> , <i>Pycnogonum tenue</i> .
3708	May 8	Ose Saki, S, 55°; W, 2.25 mi.	60-70	-----	gn. m.-----	<i>Nymphon japonicum</i> , <i>Ascorhynchus auchenicus</i> , <i>Pycnogonum tenue</i> .
3715	May 11	Ose Saki, S, 56°; W, 1.6 mi.	65-68	-----	vol. s., sh, r.-----	<i>Anoplodactylus gestiens</i> .
3716	May 11	Ose Saki, S, 36°; W, 0.8 mi.	65-125	-----	vol.s., sh, r.-----	<i>Pycnogonum tenue</i> .
3730	May 16	Omai Zaki Lt., N, 17°; E. 14.5 mi.	34-37	-----	m., g., r.-----	<i>Nymphon japonicum</i> ; <i>Pallenis virgatus</i> ; <i>Lecythorhynchus</i> sp.
3734	May 16	Omai Zaki Lt., N, 25°; E, 11 mi.	36-48	-----	crs. gy. vol. s, brk, sh.-----	<i>Nymphon japonicum</i> , <i>Cilunculus armatus</i> .
3739	May 17	Ose Zaki, S, 25°; W, 0.25 mi.	55-65	-----	vol. s., sh., r.-----	<i>Anoplodactylus gestiens</i> .
3750	May 19	Suno Saki, S, 89°; E, 9.25 mi.	83-140	-----	gy. s., brk. sh., p.-----	<i>Nymphon japonicum</i> .
3752	May 19	Suno Saki, S, 71°; E, 3.25 mi.	54-100	-----	gy. s., g.-----	<i>Nymphon japonicum</i> .
3755	May 19	Suno Saki, S, 63°; E, 3.6 mi.	52-77	-----	gy. s., co.-----	<i>Nymphon japonicum</i> .
3757	May 19	Suno Saki, S, 64°; E, 2.5 mi.	41-50	-----	crs. co., s., g.-----	<i>Nymphon japonicum</i> .

Station No.	Date	Lat. N.	Long. E.	Depth	Temp. °F.	Type of bottom	Species of pycnogonids
	1906	° ' "	° ' "	Fathoms			
4780	June 7	52 01	174 39	1,046	35.9	gy. m., s., p.-----	<i>Nymphon dissimilis</i> .
4803	June 24	46 42	151 45	229	35.9	crs. p., bk. s.-----	<i>Phozichilidium ungelatum</i> , <i>horribilis</i> . <i>Colossendeis dosleini</i> , <i>Pycnogonum ungelatum</i> .
4804	June 24	46 42	151 47	229	35.9	crs. p., bk. s.-----	<i>Colossendeis dosleini</i> , <i>Pycnogonum ungelatum</i> .
4809	July 16	41 18	140 08 40	207-90	35.9	gy. s., p., brk. sh.-----	<i>Nymphon japonicum</i> .
4822	July 21	37 08 10	137 08	130	39.4	gn. m.-----	<i>Nymphon elongatum</i> .
4826	July 21	37 25	137 32	114	42.5	fn. gy. s., bk. sp.-----	<i>Nymphon japonicum</i> , <i>albatrossi</i> , <i>Phozichilidium ungelatum</i> .
4829	July 22	37 20	137 41 30	527-548	32.9	gn. m.-----	<i>Nymphon japonicum</i> .
4833	July 23	36 13 40	135 56 30	79	-----	dk. gy. s., r.-----	<i>Nymphon japonicum</i> .
4842	July 26	36 13	133 27	82	54.6	fn. gn. s., sh.-----	<i>Nymphon albatrossi</i> , <i>Phozichilidium ungelatum</i> .
4854	July 30	35 54	129 46	335	32.4	gn. m.-----	<i>Nymphon uniunguiculatum</i> .
4891	Aug. 9	32 27	128 34	181	50.2	gy. s., brk. sh., r.-----	<i>Phozichilidium ungelatum</i> .
4893	Aug. 9	32 32	128 32 50	95-106	55.9	gy. s., brk. sh., p.-----	<i>Pycnogonum tenue</i> .

## APPENDIX TABLE 1—Continued

LIST OF STATIONS AT WHICH PYCNOGONIDS WERE COLLECTED BY THE ALBATROSS, 1900 AND 1906—continued

Station No.	Date	Lat. N.	Long. E.	Depth	Temp. °F.	Type of bottom	Species of pycnogonids
	1906	° ' "	° ' "	Fathoms			
4895	Aug. 9	32 33 10	128 32 10	95		gn. s., brk. sh., p.	<i>Pycnogonum tenue</i> .
4900	Aug. 10	32 28 50	128 34 40	139	52.9	gy. s., brk. sh.	<i>Ascorhynchus glabroides</i> .
4908	Aug. 11	31 40	129 29 40	434	42.9	gy., glob., oz.	<i>Pallenopsis tydemani</i> .
4909	Aug. 11	31 38 30	129 27 30	434		gy., glob., oz.	<i>Nymphon albatrossi</i> .
4912	Aug. 12	31 39 40	129 20	391		gy. glob., oz.	<i>Colossendeis japonica</i> , <i>nasuta</i> .
4913	Aug. 12	31 39 10	129 22 30	391		gy. glob., oz.	<i>Nymphon albatrossi</i> .
4915	Aug. 12	31 31	129 25 30	427		gy. glob., oz., brk. sh.	<i>Nymphon albatrossi</i> ; <i>Colossendeis japonica</i> .
4919	Aug. 13	30 34	129 19 30	440	41.8	glob., oz.	<i>Nymphon albatrossi</i> .
4933	Aug. 16	30 59	130 29 50	152	56.0	rky.	<i>Pycnogonum tenue</i> .
4934	Aug. 16	30 58 30	130 32	103-152		rky.	<i>Nymphon japonicum</i> .
4936	Aug. 16	30 54 40	130 37 30	103		st.	<i>Nymphon japonicum</i> .
4958	Aug. 23	32 36 20	132 24 30	405	40.1	gn.-br. m., fn gy. s., for.	<i>Phorichilidium unguellatum</i> .
4960	Aug. 23	32 34	132 24 45	578	38.7	gn.-br. m., fn gy. s., for.	<i>Nymphon nipponense</i> .
4965	Aug. 28	33 35 20	135 10 50	191	49.4	dk. gn.-gy. s., sh.	<i>Nymphon kodanii</i> .
4967	Aug. 29	33 25 10	135 37 20	244-253	45.9	br. m., s., for.	<i>Nymphon nipponense</i> .
4969	Aug. 29	33 23 40	135 33	587	38.9	br. m., s., st.	<i>Phorichilidium unguellatum</i> ; <i>Colossendeis angusta</i> .
4970	Aug. 30	33 23 30	135 36 30	500-649	39.1	br. m., bk. s., sh.	<i>Pallenopsis stylirostre</i> .
4971	Aug. 30	33 23 30	135 34	649	38.1	br.-gn. m., for.	<i>Nymphon kodanii</i> .
4973	Aug. 30	33 24 15	135 30 30	600	38.2	br. m., st.	<i>Phorichilidium unguellatum</i> .
4974	Aug. 31	33 18 10	135 40 50	905	36.6	br.-gn. m., for.	<i>Colossendeis colossea</i> .
4975	Aug. 31	33 21 30	135 38 50	545-712	37.5	br. m., p., for.	<i>Nymphon ohshimai</i> , <i>nipponense</i> ; <i>Pallenopsis mollissima</i> , <i>stylirostre</i> ; <i>Colossendeis angusta</i> .
4977	Aug. 31	33 23	135 37 40	544	38.9	br. m., fn. s.	<i>Nymphon nipponense</i> , <i>kodanii</i> .
4980	Sept. 1	34 09	137 55	507	39.0	br. m., fn. s., for.	<i>Nymphon nipponense</i> , <i>Ascorhynchus japonicus</i> , <i>Colossendeis angusta</i> .
4982	Sept. 19	43	140 10 30	390-428	32.7	gn. m.	<i>Nymphon longitarse</i> , <i>uniungiculatum</i> , <i>Colossendeis chitinosa</i> .
4987	Sept. 20	43 19 20	140 17	59	44.8	rky.	<i>Decachela discata</i> .
5018	Sept. 26	46 41 30	143 57 40	100	30.4	br. m., bk. s., p.	<i>Nymphon hodgsoni</i> .
5020	Sept. 27	48 32 45	145 07 30	73	30.9	gn. m., s., p.	<i>Nymphon longitarse</i> , <i>hodgsoni</i> .
5021	Sept. 27	48 32 30	145 08 45	73	30.9	gn. m., s., p.	<i>Nymphon longitarse</i> , <i>hodgsoni</i> , <i>Achelia superba</i> , <i>Cilunculus armatus</i> .
5023	Sept. 27	48 43 30	145 03	75	30.9	s., p.	<i>Nymphon longitarse</i> , <i>hodgsoni</i> , <i>elongatum</i> .
5024	Sept. 27	48 43 10	144 59 30	67	30.9	s., p.	<i>Nymphon longitarse</i> , <i>braschnikowi</i> .
5025	Sept. 27	48 43 30	144 56 45	52	31.7	p.	<i>Nymphon longitarse</i> , <i>hodgsoni</i> , <i>braschnikowi</i> .
5026	Sept. 28	48 36 10	145 17 30	119	30.4	gn. m., bk. s., g.	<i>Nymphon braschnikowi</i> .
5029	Sept. 28	48 22 30	145 43 30	440	35.3	bk. s., g.	<i>Colossendeis dofleini</i> .
5032	Sept. 30	44 05	145 30	300	34.9	br. m., fn. bk. s., g.	<i>Ascorhynchus japonicus</i> .
5037	Oct. 2	42 02 40	142 33 20	175-349	37.9		<i>Nymphon longitarse</i> , <i>braschnikowi</i> , <i>Achelia borealis</i> , <i>Cilunculus armatus</i> .
5038	Oct. 2	42 02 40	142 36	175	37.1	fn. bk. s., br. m., brk. sh.	<i>Nymphon braschnikowi</i> .
5040	Oct. 3	42 14 20	142	140-269	41.1	gn. m.	<i>Nymphon longitarse</i> .
5043	Oct. 3	42 10 20	142 15 20	330	37.9	br. m., fn. bk. s., co., s.	<i>Colossendeis angusta</i> .

## APPENDIX TABLE 1—Continued

LIST OF STATIONS AT WHICH PYCNOGONIDS WERE COLLECTED BY THE ALBATROSS, 1900 AND 1906—continued

Station No.	Date	Lat. N.	Long. E.	Depth	Temp. °F.	Type of bottom	Species of pycnogonids
	1906	° ' "	° ' "	Fathoms			
5050	Oct. 10	38 11 30	142 08	266	37.9	dk. gy. s., brk. sh., for.	<i>Nymphon gunteri</i> , <i>heterospinum</i> ; <i>Colossendeis angusta</i>
5075	Oct. 15	34 38 15	138 16 15	22	75.0	fne. br. s.	<i>Anoplodactylus</i> sp.
5078	Oct. 19	34 12 20	138 02 30	475-514	38.9	fn. gy. s., glob.	<i>Anoplodactylus</i> sp.
5079	Oct. 19	34 15	138	475-505	39.1	p.	<i>Phorichilidium ungelatum</i> ; <i>Ascorhynchus japonicus</i> ; <i>Colossendeis doylei</i>
5080	Oct. 19	34 10 30	138 40	505	38.7	fn. gy. s., glob.	<i>Nymphon micropedes</i> ; <i>Paltenopsis mollissima</i> ; <i>Phorichilidium ungelatum</i>
5082	Oct. 20	34 05	137 59	662	37.7	gn. m., fn. s., glob.	<i>Ascorhynchus japonicus</i> ; <i>Colossendeis colossea</i>
5083	Oct. 20	34.04.20	137 57 30	624	38.1	fne. gy. s., glob.	<i>Ammothella profunda</i> ; <i>Colossendeis angusta</i> , <i>macerrima</i>
5084	Oct. 20	34	137 49 40	918	36.8	gn. m., fn. s., glob.	<i>Ascorhynchus japonicus</i>
5085	Oct. 23	35 06 45	139 19 45	622	37.8	gn. m., fne. bk. s.	<i>Nymphon benthos</i>
5094	Oct. 26	35 04 42	139 38 20	88	54.8	bk. s., brk. sh.	<i>Ascorhynchus japonicus</i>

## Shore collections:

June 23 Milne Bay, Simushiru..... *Achelia pribilofensis*, *Achelia* sp.; *Pycnogonum buticulosum*.  
 July 3 Hakodate..... *Callipallene dubiosa*.

## APPENDIX TABLE 2

LOCALITIES AT WHICH PYCNOGONIDS HAVE BEEN COLLECTED IN SIBERIAN WATERS, TAKEN FROM LOSINA-LOSINSKY, 1933

Station No.	Date	Lat. N.	Long. E.	Depth	Temp.	Type of bottom	Species of pycnogonids
	1925	<i>Peter the Great Bay and vicinity</i>			°C.		
243	Aug. 19	° ' " ° ' "		<i>Meters</i> 40			<i>Nymphon striatum</i> .
351	Aug. 29	bet. Egermold & Peschan.		35.5			<i>Nymphon striatum</i> .
27	Sept. 10	Amur Bay		40		s. sh.	<i>Nymphon striatum</i> .
48	Sept. 23	bet. Skrilev & Cape Basargin		12-16		sa. m.	<i>Nymphon striatum</i> .
58	Sept. 28	Peter the Great Bay				from sargassum on stones	<i>Achelie echinata orientalis</i> .
64	Oct. 6	nr. Peter the Great Bay				clean rd. s.	<i>Halosoma derjugini</i> .
66	Oct. 6	42 57.5   131 51.8		7		clean gy. s.	<i>Nymphon striatum</i> .
	Oct. 12	bet. Lavrova & Naumova		20		gy. s.	<i>Nymphon striatum</i> .
	Oct. 12	Peter the Great Bay		50-52			<i>Nymphon longicarse</i> .
	Nov. 27	44 27.5   140 20					
		[Tarasov]					
	1926						
1	Aug. 7	Postava Bay		6.7	18.2	dk. gy. s.	<i>Nymphon striatum</i> .
6	Aug. 8	Expedition Bay		7.5		gy. m.	<i>Nymphon striatum</i> .
9	Aug. 10	Novgorod Bay		9	19.2	m.	<i>Nymphon striatum</i> .
12	Aug. 11	Troitsa Bay		4.4		m.	<i>Nymphon striatum</i> .
16a	Aug. 11	Postava Bay		2.5-5			<i>Nymphon striatum</i> .
25	Aug. 19	Novgorod Bay		7	21.9	m.	<i>Nymphon striatum</i> .
38	Aug. 27	Novgorod Bay		2.3	22.8	gy. m.	<i>Nymphon striatum</i> .
40a		Postava Bay		3.6			<i>Nymphon striatum</i> .
44	Aug. 31	Novgorod Bay		10.5	21.4		<i>Nymphon striatum</i> .
46	Sept. 1	Novgorod Bay		1.25-2	23.4	oysters	<i>Nymphon striatum</i> .
47	Sept. 3	Expedition Bay		4	22.1	bk. muddy s.	<i>Nymphon striatum</i> .
64	Sept. 14	Peter the Great Bay		1.67-2.67			<i>Nymphon striatum</i> .
		<i>Kuznetsov, coll.</i>					
	Aug. 11	Patroclus Bay		.5		zoostera	<i>Lecythorhynchus marginatus</i> .

Derjugin, coll.									
	Sept. 29	42 53.3		131 50	50		gy. muddy s.		<i>Nymphon striatum</i> .
	Sept. 29	Usuri Bay							<i>Nymphon striatum</i> .
212	Oct. 23	Peter the Great Bay				40		gy. sa. m.	<i>Nymphon striatum</i> .
[Litke]									
1929									
8	July 31	Bering Sea				19	.07		<i>Nymphon brevirostre glaciale</i> .
14	Aug. 7	71 03	175		60		gy. gn. m.		<i>Nymphon longitarse brevicollis</i> .
15	Aug. 7	71 04	175		61		gy.-gn. m.		<i>Nymphon longitarse brevicollis</i> , <i>brevirostre glaciale</i> , <i>grossipes</i> .
18	Aug. 10	71 08 50	175 16		46		fn. p.		<i>Nymphon longitarse brevicollis</i> .
19	Aug. 10	71 08 40	175 19		46		fn. p.		<i>Nymphon grossipes</i> .
20	Aug. 10	71 08 30	175 22		45	1.76	fn. p.		<i>Nymphon longitarse brevicollis</i> .
22	Aug. 11	70 56	175 35		58	1.75	m.		<i>Nymphon longitarse brevicollis</i> , <i>grossipes</i> .
23	Aug. 12	70 52	175 35		54		m.		<i>Nymphon longitarse brevicollis</i> .
26	Aug. 18	70 54	175 38		53		m. & p.		<i>Nymphon longitarse brevicollis</i> .
27	Aug. 20	70 41 5	170 54		54		m. & p.		<i>Nymphon longitarse brevicollis</i> .
28	Aug. 21	70 37 40	179 09		57.5		m. & p.		<i>Nymphon longitarse brevicollis</i> .
29	Aug. 22	70 57 30	176 08		58		m. & p.		<i>Nymphon longitarse brevicollis</i> .
30	Aug. 22	70 37	176 07		68.5		m. & p.		<i>Nymphon longitarse brevicollis</i> .
31		70 40	175 43		66	1.74	m. & p.		<i>Nymphon brevirostre glaciale</i> .
33	Aug. 25	70 52	175 12		70	1.75	m.		<i>Nymphon brevirostre glaciale</i> .
34	Aug. 25	71 05 30	175 11			1.72	p.		<i>Nymphon longitarse brevicollis</i> , <i>brevirostre glaciale</i> .
38	Aug. 27	71 22	175 12		61.5		p.		<i>Nymphon longitarse brevicollis</i> .
50	Sept. 7	70 57	175 04		72	0.59	p.		<i>Nymphon longitarse brevicollis</i> .
51	Sept. 8	70 19 5	174 17		52	0.76	gy.-gn. m.		<i>Nymphon longitarse brevicollis</i> .
56	Sept. 9	69 04	175 28		52	1.74	m.		<i>Nymphon brevirostre glaciale</i> .
68	Sept. 17	Bering Sea				16		lava & m.	<i>Nymphon longitarse brevicollis</i> , <i>brevirostre glaciale</i> .
	Oct. 14	Bering Sea				8-10		s.	<i>Achelia alaskensis</i> , <i>uschakovi</i> , <i>laurenti</i> , <i>litke</i> .
72	Oct. 19	Bering Sea, Providence Bay				8-5		muddy s.	<i>Phorichthidium femoratum</i> .
76		Bering Sea				20		m.	<i>Nymphon longitarse brevicollis</i> , <i>brevirostre glaciale</i> .





8	Sept. 25	Peter the Great Bay	58	s	<i>Nymphon striatum</i> .
9	Sept. 25	Peter the Great Bay	58	st	<i>Nymphon striatum</i> .
9	Sept. 19	C. Gamova	79	s	<i>Nymphon longitarse</i> .
11	Sept. 25	Peter the Great Bay	67	s	<i>Nymphon striatum</i> .
12	Sept. 19	C. Gamova	190	m. & s	<i>Nymphon longitarse</i> .
13	Sept. 25	Furugelma Id.	130	m	<i>Achelia borealis japonica</i> .
<b>Красный Якут</b>					
<b>1930</b>					
122/7c	July 17	48 58 2   140 35 3	75	0.6-0.8	<i>Pycnosoma strongylocentroti</i> .
133/18	July 31	54 33   142 40	67	1.5	<i>Nymphon grossipes</i> .
134/19	Aug. 1	56 08   144 55	287	1.16	<i>Nymphon grossipes</i> .
135/20	Aug. 1	56 45   145 50	218	1.5	<i>Nymphon grossipes</i> .
139/24	Aug. 3	59 05   140 19 5	96	0.94	<i>Nymphon longitarse</i> .
389/56	Sept. 27	C. Povorotni (nr. 42°40' 133°02')		s	<i>Nymphon hodgsoni</i> .
	Nov. 6	43 54 7   135 42 7	107-142	p	<i>Nymphon longitarse, hodgsoni</i> .
<b>Rossinante</b>					
<b>1931</b>					
250	Oct. 2	Peter the Great Bay, nr. Furugelma Id.	121		<i>Nymphon longitarse</i> .
257	Oct. 3	Peter the Great Bay	156-171		<i>Nymphon longitarse</i> .
712	Oct. 3	Peter the Great Bay	156-171		<i>Nymphon hodgsoni</i> .
271	Oct. 5	Peter the Great Bay	775-955		<i>Nymphon longitarse</i> .
274	Oct. 6	Peter the Great Bay	100-155		<i>Nymphon longitarse</i> .
283	Oct. 7	Peter the Great Bay	510-545	m	<i>Nymphon untinguiculatum</i> .
30	Oct. 6	Rimsky-Korsakov Id.	123-150		<i>Nymphon longitarse</i> .
33	Oct. 6	Peter the Great Bay	170-210		<i>Nymphon longitarse, hodgsoni</i> .
44	Oct. 20	Amur Bay			<i>Nymphon striatum</i> .
	Oct. 31	Vladivostok			<i>Nymphon hodgsoni</i> .
<b>1932</b>					
307	July 12	Peter the Great Bay	1600-1690		<i>Nymphon longitarse</i> .
	1931	Okhotsk Sea			<i>Nymphon grossipes</i> .
	Sept. 18	Peter the Great Bay, Furugelma Id.	167-340	m	<i>Nymphon longitarse, untinguiculatum</i> .



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## MAMMALS OF NORTHERN COLOMBIA

### PRELIMINARY REPORT NO. 4: MONKEYS (PRIMATES), WITH TAXONOMIC REVISIONS OF SOME FORMS

By PHILIP HERSHKOVITZ

MONKEYS collected in northern Colombia by the author during his tenure of the Walter Rathbone Bacon Traveling Scholarship number 202 specimens. The genera of simians known to occur in the region are *Cebus*, *Ateles*, *Alouatta*, *Aotus*, and *Marikina*. Each of these genera is represented in the collection by one species.

The greater part of this report is devoted to a taxonomic review of the whole of that group of the genus *Cebus* which includes the species collected. The other cebid genera, *Ateles*, *Alouatta*, and *Aotus*, are treated with more circumscription, as the taxonomic problems affecting them are less embroiled. The bare-faced tamarins, genus *Mari-kina*, which include the three species of northern Colombian marmosets, are revised. The remaining tamarins of the same genus, and the little lion-monkeys, genus *Leontocebus*, are also discussed and arranged by species.

Nearly all pertinent type specimens preserved in this country, in London, and in Paris have been examined. For permission to study this material, as well as for the loan of specimens from various American institutions, the author expresses his thanks to the authorities of the Muséum National d'Histoire Naturelle, Paris, the British Museum (Natural History), the American Museum of Natural History, the Chicago Natural History Museum, the Museum of Comparative Zoology, Harvard University, and the Carnegie Museum.

#### COLOR TERMS AND ABBREVIATIONS

Capitalized color terms are from Ridgway (Color Standards and Color Nomenclature, pp. vi+44, 53 plates, 1912). The following

abbreviations represent the institutions whose collections of monkeys were examined:

- A.M.N.H.=American Museum of Natural History, New York.  
B.M. =British Museum (Natural History), London.  
C.M. =Carnegie Museum, Pittsburgh.  
C.N.H.M.=Chicago Natural History Museum.  
M.C.Z. =Museum of Comparative Zoology, Cambridge.  
M.N.H.N.=Muséum National d'Histoire Naturelle, Paris.  
U.S.N.M. =United States National Museum, Washington.

### GENUS *CEBUS* ERXLEBEN: MICOS AND MACHINES

The 66 micos collected in northern Colombia are referable to *Cebus albifrons*. No other species of the genus occurs in the area. Other species of *Cebus* found elsewhere in Colombia are *C. capucinus*, *C. nigrivittatus*, and *C. apella*. The last species mentioned represents a section of the genus hereinafter referred to as "tufted." The others compose the "untufted" section.

Before listing the forms collected, it is necessary to characterize each of the representative species of the genus *Cebus* and to establish the bases for the nomenclature adopted here. The more recent publications on the subject, being those currently accepted as guides to characters and nomenclature of the species of *Cebus*, are critically reviewed. The status of each of the names correctly or incorrectly applied to an "untufted" *Cebus* is examined. The status of each of the named forms of "tufted" *Cebus* will be dealt with in a report being prepared by Dr. Remington Kellogg.

#### CHARACTERS AND COMPARISONS OF "UNTUFTED" AND "TUFTED" SPECIES

Attempts to separate "tufted" from "untufted" cebids on the basis of cranial characters have never been wholly satisfactory. Tate (1939, p. 210) offered a table of comparative differences in skulls of the two groups. He pointed out, however (p. 209), that the differences are relatively small and that characters that hold for one sex are sometimes invalid for the other. Certain of these differences have been found to have a qualified and relative value when applied to present material. The character referring to the sagittal crest appears to be valid; that of the structure of the mandible holds in most cases. Characters referring to the relation of the maxillomalar suture to the lower margin of the orbit, and to the dimensions of the external narial opening, lose significance in present examples. The character of width of pterygoid fossa as given by Tate is too relative. Restated, however, that character forms parts of a more complex difference between the two groups of *Cebus*. Cranial characters distinguishing the groups are given in the following tabulation.

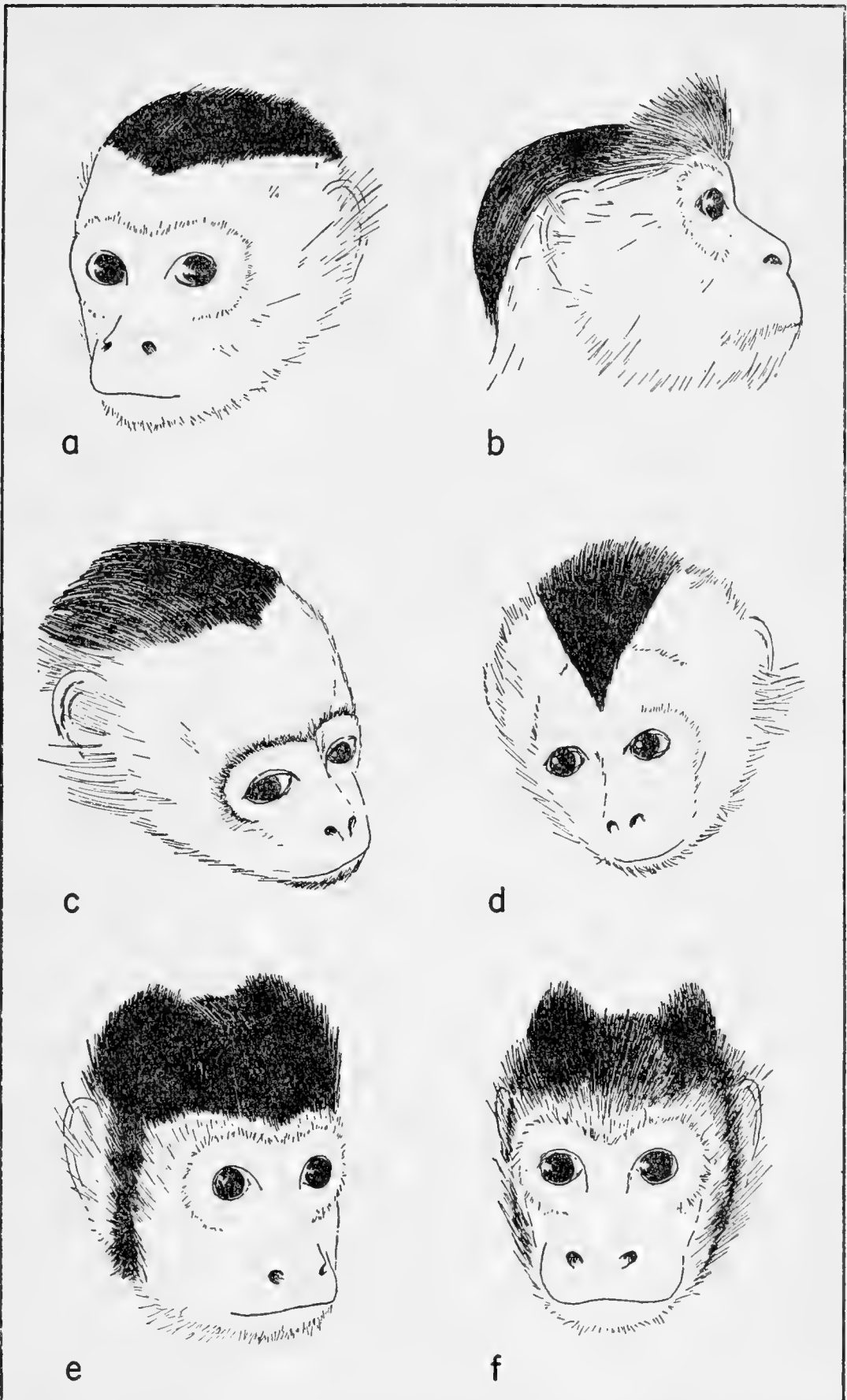


FIGURE 52.—Head patterns of *Cebus*: a, *C. albifrons*; b, *C. albifrons* (female with moderately developed superciliary brush); c, *C. capucinus*; d, *C. nigrivittatus*; e, f, *C. apella* with prominent and moderately developed tufts, respectively.

## "UNTUFTED"

(*Cebus capucinus*, *C. albifrons*, *C. nigrivittatus*)

(Pls. 15, a; 16, a)

1. Temporal ridges weakly developed, more or less parallel-sided, never converging to form a sagittal crest.

2. Bony rings encircling orbits joined at roots of nasals to form well-defined, nearly horizontal superciliary ridges. Frontals above orbits plane or slightly rounded in males, more rounded in females.

3. Brain case relatively low, dolichocephalic.

4. Ramus of mandible in males comparatively low, depth from condyle usually less than length of C-M<sup>3</sup>; in females, mandible weaker with ramus relatively lower.

5. Vomer situated more posteriorly, the vertical plate nearly always well exposed behind plane of posterior border of palate; wings of vomer heavy, little, or not at all separated from each other, the presphenoid, if present, not visible from ventral aspect.

6. Pterygoid fossa and posterior narial openings wider, the internal pterygoid plate and hamular processes tending to converge.

None of the above characters are absolute. It is believed, however, that any normal adult skull selected at random can be correctly classified by a judicious determination of which set of cranial characters best applies. This, taken together with external characters given below, should be ample for positive identification.

## "UNTUFTED"

(*Cebus capucinus*, *C. albifrons*, *C. nigrivittatus*)

1. Frontal tufts normally absent in males; when present in females, placed well forward and in form of superciliary brush or frontal diadem with the long, erect hairs radiating from midfrontal

## "TUFTED"

(*Cebus apella*)

(Pls. 15, b; 16, b)

1. Temporal ridges more developed, convergent, in old males uniting to form a sagittal crest.

2. Superciliary ridges weak or obsolete; temporal ridges rising obliquely up and back from bony rings of orbits to define a triangular-shaped forehead in adult males and old females. Frontal region above orbits always forming a convex eminence with a pronounced vaulting in females.

3. Brain case more vaulted, less dolichocephalic.

4. Ramus of mandible in males comparatively high, depth from condyle usually more than length of C-M<sup>3</sup>; in females, mandible generally as in males of "untufted" but with ramus averaging relatively higher.

5. Vomer situated more anteriorly, the vertical plate hardly, or not at all, exposed behind plane of posterior border of palate; wings of vomer more delicate, well spread, revealing a presphenoid (normally distinct but may be fused to basisphenoid, especially in old males).

6. Pterygoid fossa and narial openings narrower, the internal pterygoid plates more nearly parallel-sided, the hamular processes tending to diverge.

## "TUFTED"

(*Cebus apella*)

1. Frontal tufts usually present in adults of both sexes; tufts may be paired with one on each side of crown in form of "horns," ridges, or lines of short erect hairs, or as a single brushlike

region and of same general coloration as rest of forehead. (Fig. 52, b.)

2. Cap of crown, in males and untufted females, broad or narrow, rounded in front or pointed, greatest width from one-third to nearly total distance between ears. A midfrontal line or wedge of dark hairs to root of nose present or absent. (Fig. 52, a, c, d.)

3. Dark preauricular band absent; sides of face, chin, throat whitish to brown, rarely with darker streaks on cheeks. (Fig. 52, a-d.)

topknot or transverse ridge; never in form of thin superciliary brush or diadem; color of hairs of tufts, at least terminally, like coronal cap and contrasting with pale superciliary band, if present. (Fig. 52, e, f.)

2. Cap of crown always broad, never acutely pointed or wedge-shaped in front, greatest width nearly equal to distance between ears. A midfrontal wedge, never a line, of dark hairs to root of nose often present. (Fig. 52, e, f.)

3. A contrastingly dark preauricular band on each side of face usually present; the bands normally extending from cap to under chin where they may unite. (Fig. 52, e, f.)

Number of lumbar vertebrae has often been cited as distinctive for each group or, at least, for certain species of each group. Members of the "tufted" group are said to have five lumbar vertebrae, and six are attributed to the "untufted" species. The following number of vertebrae have been noted in each of the available skeletons in the United States National Museum collection:

"TUFTED" (*C. apella*, Matto Grosso, Brazil)

No. 270360	♀	7 cervical	12 thoracic	6 lumbar	3 sacral
No. 270361	♂	7 cervical	13 thoracic	5 lumbar	3 sacral

"UNTUFTED" (*C. capucinus*, Central America)

No. 256742	♀	7 cervical	14 thoracic	6 lumbar	3 sacral
No. 25310	—	7 cervical	14 thoracic	5 lumbar	3 sacral

"UNTUFTED" (*C. albifrons*, northern Colombia)

No. 281565	♂	7 cervical	15 thoracic	6 lumbar	2 sacral
No. 281569	♂	7 cervical	15 thoracic	5 lumbar	3 sacral
No. 281570	♀	7 cervical	14 thoracic	6 lumbar	3 sacral
No. 281606	♂	7 cervical	14 thoracic	6 lumbar	3 sacral

Apparently the difference between "tufted" and "untufted" species lies in the number of thoracic vertebrae. However, too few specimens have been examined for affirming any real difference between the groups on the score of number of precaudal vertebrae. So far it can be said that total of combined number of thoracic, lumbar, and sacral vertebrae is 22 or 23 in "untufted," and 21 in "tufted" cebids.

COMPARISONS OF *CEBUS ALBIFRONS* AND *CEBUS NIGRIVITTATUS*

Among "untufted" cebids, the black white-fronted *Cebus capucinus* of Central America, western Colombia, and western Ecuador is readily distinguished from all others. In color pattern of body, "untufted"



*Cebus albifrons* partially resembles pale, or erythristic, members of the "tufted" group, while *C. nigrivittatus* could be confused with dark brown or blackish "tufted" monkeys. Superficial characters separating *albifrons* from *nigrivittatus* are outlined below and may be of additional service in distinguishing them from "tufted" forms.

*Cebus albifrons*

(Fig. 52, a-b)

1. Cap in males (and females without superciliary brush or frontal diadem), usually well rounded, extending from crown to back of head, and broadly outlined in front by whitish to buffy superciliary or transverse frontal band; height of superciliary band equal to about one-half distance between ears, and with or without a dark median line from cap to root of nose.

2. Back and sides of body more or less uniformly yellowish to reddish or brown; median dorsal band, if present, poorly defined; hairs uniformly colored or with bases paler and never with sharply contrasting paler tips.

3. Tail never blackish, upper side like back or with hairs punctulated, usually becoming paler terminally.

4. Hairs of outer side of forearm and foreleg uniformly yellowish to reddish or brown or gradually becoming paler from tip to base; sometimes with distinct annulations or paler tips; wrist, ankle, and upper surface of hand and foot not markedly darker.

5. Hairs of chest and belly usually paler than terminal portions of hairs of back.

6. Pelage generally smoothly adpressed and of a soft, silky texture.

*Cebus nigrivittatus*

(Fig. 52, d)

1. Cap in males (and untufted females) smaller, narrower, triangular or wedge-shaped with apex in front, usually restricted to crown and sharply outlined from sides of head; pale superciliary band narrower, height at mid-frontal line about one fourth or less distance between ears and usually with a line or wedge of dark hairs from cap to root of nose.

2. Back and sides yellowish to nearly black, median dorsal band, when present usually moderately well defined; hairs at least of sides of back usually conspicuously annulated, the wide pale terminal bands contrasting with darker subterminal portions.

3. Tail above like back proximally, usually becoming darker terminally,

4. Hairs of outer side of forearm and foreleg dark brown or gray basally or subterminally, sharply paler terminally; wrist, ankle, and upper surface of hand and foot usually contrastingly darker, or blackish.

5. Hairs of chest and belly usually darker than terminal portions of hairs of back.

6. Pelage generally lax and of a coarser texture.

In general, *C. albifrons* is delicately built and brightly colored, with forearms, legs, and tail never blackish as in the "tufted" species. In contrast, *nigrivittatus* is larger, more robust and somberly colored, and approaches the "tufted" forms in color of limbs and tail. Its skull is larger and more dolichocephalic than that of *albifrons*. A more detailed description of *Cebus albifrons* is given later under specific and sub-specific headings.

## REVIEW OF RECENT LITERATURE

Three species of "untufted" micos are identifiable. First, *Cebus capucinus* Linnaeus, 1758. It is distinguished from all others by the uniformly black pelage on crown, back, sides, tail, and limbs contrasted with the whitish to buffy face, forehead, throat, sides and front of neck, chest, shoulders, and inner and front sides of upper arms. This mico is referred to in this discussion as the black white-fronted *Cebus*. The second species is *Cebus albifrons* Humboldt, or the brown pale-fronted *Cebus*. Its color is distributed in much the same pattern as in the first except that the black is replaced by a tone of yellowish to dark brown and the pale frontal area is warmer and more restricted in extension. The third "untufted" species is the much-misconstrued *Cebus capucinus* of authors (not Linnaeus), or *Cebus nigrivittatus* Wagner. This is also a brown monkey but usually darker than the second, tending to blackish on the much smaller, wedge-shaped cap, middorsal line, hands, and feet. In addition, the contrastingly pale front of the first and second species is here much less, or hardly at all contrasting, and is extremely restricted in area. The "tufted" group is represented by a single species in Colombia, *Cebus apella* Linnaeus. It is doubtful if more than one species of "tufted" *Cebus* can be recognized at any one locality.

In his review of the Primates, Elliot (1913, p. 77) listed 24 forms of *Cebus*, of which 20 were given full specific rank. In his key Elliot sorted these into two major groups, "A. Head without tufts on male." and "B. Heads with tufts or ridges on male." Cranial characters exclusive of measurements were not used in the key or in any of the descriptions of recognized forms. This arrangement does not convey the true characters of the monkeys involved, nor does it necessarily correspond to established concepts of what constitutes a "tufted" or "untufted" species of *Cebus*. All forms listed by Elliot in his group "B" are indeed "tufted." However, his group "A" includes names of three truly "tufted" cebids, though the tufts may not have been obvious in the material examined by Elliot, or they may have been overlooked at the time he composed the key. The three are *Cebus apella*, *Cebus frontatus*, and *Cebus variegatus*. The type specimens of *frontatus* and *variegatus* were examined by the writer and found to be "tufted." Elliot's description, in the text, of each of these forms conforms to the definition of a "tufted" *Cebus* in spite of their inclusion in the "untufted" section of his key. The description and comparisons of *C. apella* given by Elliot (pp. 80-82) also show clearly that it is a tufted *Cebus*. On the other hand, Elliot's synonymy of *apella* is a composite of "tufted" and "untufted" cebids. His citations of synonyms of "tufted" monkeys include *apella* Erxleben, *fulvus* Kerr, *apella* Humboldt, *griseus* Desmarest, *apella* Wagner, *pucherani* [sic]

Dahlbom, *hypomelas* Pucheran, *annellatus* Gray, *fallax* Schlegel, and a number of general references. Elliot had examined whatever types existed of the above-named forms. "Untufted" forms included by Elliot in the synonymy of *apella* are *nigrivittatus* Wagner and *olivaceus* Schomburgk. Elliot did not see the types of either of these and he discussed only the second. His interpretation of the original description of *olivaceus* led him to believe that it was "tufted" and similar to *apella* and *fatuellus*, but nearer the first. From the foregoing it is evident that what Elliot described as *C. apella* and the types he actually examined and believed to be synonyms of *apella* are indeed "tufted" monkeys and may be designated as *Cebus apella*. On the other hand Elliot erred gravely in assuming that *Cebus capucinus* of authors (not Linnaeus) was equivalent to *Cebus apella*. These "authors" (discussed in the following section) painstakingly differentiated between the "tufted" monkey which they identified as *C. apella* and the brown "untufted" monkey which, for lack of any other available name, they termed *C. capucinus*. It should be understood that early authors based their identifications mainly on the 1766, or twelfth, edition of the "Systema Naturae" of Linnaeus and on the thirteenth, or Gmelin edition, of the Linnaean work. Since all other true cebids, namely, *apella*, *trepidus*, and *fatuellus*, of these editions are patently "tufted," authors settled upon *capucinus* (not *capucinus*, 1758) as representing the "untufted" form. As some of the specimens upon which these determinations were made are still extant, Elliot's opinion regarding the identity of *capucinus* of authors is unadvised and has created confusion that will long survive in some quarters.

In 1917 Cabrera published notes on *Cebus*. These documents were at the same time a critical review of Elliot's contributions to the same subject and an attempt to organize the components of the genus into a natural order. In this Cabrera succeeded in correcting the more serious errors into which Elliot had fallen and in offering a sound foundation, the first such, upon which to establish a clear understanding of the true relationships between the species of *Cebus*. In his paper Cabrera immediately affirmed the "tufted" nature of *Cebus apella* and disengaged from its synonymy the *Cebus capucinus* of authors. For the latter, Cabrera established the pertinency of the name *Cebus nigrivittatus* Wagner. Cabrera's classification of "untufted" cebids may be summarized as follows:

C. NIGRIVITTATUS GROUP

1. *Cebus nigrivittatus* Wagner

*Saï Buffon*

*C. capucinus* authors (*nec* Linnaeus)

*Sajou mâle* Cuvier

*Saiou brun femelle* Cuvier

*Cebus griscus* F. Cuvier (*nec* Desmarest)

- C. annellatus* Gray [a "tufted" Cebus]
- C. pucherani* [sic] Dahlbom
- C. paraguayanus* Reichenbach (*nec* Fischer)
- C. apiculatus* Elliot
- C. apella brunneus* Allen
- 2. *Cebus olivaceus* Schomburgk
- Saï variété* B, Audebert
- C. barbatus* Desmarest (*nec* E. Geoffroy)
- C. castaneus* I. Geoffroy

## C. ALBIFRONS GROUP

- 3. *Cebus albifrons* Humboldt
- 4. *Cebus gracilis* Spix
- C. flavescens cuscinus* Thomas
- 5. *Cebus chrysopus* [sic] Cuvier
- 6. *Cebus aequatorialis* Allen
- 7. *Cebus versicolor* Pucheran
- C. leucocephalus* Gray
- 8. *Cebus malitiosus* Elliot

## "UNTUFTED" NOT REFERRED TO GROUP

- 9. *Cebus unicolor* Spix (specimens not seen)
- C. flavescens* Gray
- 10. *Simia flava* Schreber (unidentifiable)
- 11. *Cebus flavus* Geoffroy (unidentifiable)
- 12. *Cebus barbatus* Geoffroy (unidentifiable)
- 13. *Cebus albus* Geoffroy (unidentifiable)
- 14. *Cebus fulvus* Desmarest

The black white-fronted monkey was, of course, determined as *Cebus capucinus* Linnaeus (1758). *C. hypoleucus* Humboldt was treated as a synonym of the typical form and the following as races: *limitaneus*, *imitator*, *nigripectus*, *curtus*.

Considerably more material available to this writer than to Cabrera has resulted in a consolidation of the 10 "untufted" species recognized as identifiable by Cabrera into the three species *nigrivittatus*, *albifrons* (with *unicolor*), and *capucinus*. *Cebus fulvus* Desmarest is untenable for reasons shown later.

The next significant attempt to classify members of the genus *Cebus* was made by Tate (1939). He distinguished the two principal categories of cebids, the crested ("tufted") and the uncrested ("untufted"). The last he divided into three groups, which are superficially equivalent to those of Cabrera and the three "untufted" species of this report. Unfortunately, Tate's choice of names and the actual forms he referred to his several groups allowed for little of the excellent and conscientious work done by Cabrera. Whereas Elliot correctly described *C. apella* as "tufted," though this is not apparent in his key, but incorrectly coupled that name with *capucinus* of authors, Tate arrived at the conclusion that *apella* was "untufted"

and thus, of necessity, equivalent to *capucinus* of authors. There is not the slightest foundation for this conclusion either in the very references cited by Tate or in what early authors have actually identified as *apella* and *capucinus*. The three groups of "untufted" cebids as arranged by Tate are summarized below. The equivalent nomenclature of this paper is shown in brackets.

Group 1, uncrested (Tate, 1939, pp. 211-213):

<i>C. apella apella</i>	[= <i>C. nigrivittatus castaneus</i> ]
<i>C. griseus</i> Desmarest	[= "tufted" or <i>C. apella</i> Linnaeus]
<i>C. apella olivaceus</i>	[= <i>C. nigrivittatus olivaceus</i> ]
<i>C. apella apiculatus</i>	[= <i>C. nigrivittatus apiculatus</i> ]
<i>C. apella brunneus</i>	[= <i>C. nigrivittatus brunneus</i> ]
<i>C. apella malitiosus</i>	[= <i>C. albifrons malitiosus</i> ]
<i>C. aequatorialis</i>	[= <i>C. albifrons aequatorialis</i> ]

Group 2, uncrested, "essentially Amazonian in distribution" (Tate, 1939, pp. 211-212): [in the order given] *albifrons*, *gracilis*, *leucocephalus* [not Amazonian], *versicolor* [not Amazonian], *unicolor* [all the preceding referable to *albifrons*], *flavus* [unidentifiable], *castaneus* [a race of *nigrivittatus* and not Amazonian], *variegatus*? ["tufted," not Amazonian], *xanthosternos* ["tufted," not Amazonian], *robustus* ["tufted," not Amazonian], *cuscinus* [a race of *albifrons*]. On page 213, Tate listed *flavus* as a synonym of *albifrons* and, in addition to those mentioned above, added *barbatus*, *albus* [both unidentifiable], *variegatus* [without question mark], and *leucocephalus* Blainville [a *Pithecia*] as probably conspecific with *albifrons* "though representing in some cases geographical races." *Simia flava* Schreber was mentioned as "not certainly identifiable as *Cebus*."

Group 3, uncrested, "Central American division" (Tate, p. 212), with the Colombian *nigripectus* [*capucinus*] and *chrysopus* [an *albifrons* of unknown origin but probably Amazonian].

The fourth or crested group of *Cebus* (Tate, p. 212) included species regarded as "probably best treated as subspecies of *fatuellus* Linnaeus." By rejecting the first valid name, *apella*, Tate might have adopted the specific name *trepidus* Linnaeus, which has priority over *fatuellus*. Instead he listed *trepidus* (p. 213) as a subspecies of *fatuellus*. The brown uncrested or "untufted" *Cebus nigrivittatus* Wagner was also included in his crested division (p. 212).

A revision of the genus *Cebus* presented as a doctoral thesis by Pusch (1941) is the ultimate in confusion. Nothing would be gained by reviewing the work here. References to Pusch's use of names for "untufted" cebids are made in the text and in the synonymies on later pages of this work.

The late Eladio da Cruz Lima (1945) has presented an excellent pictorial description of the Primates of Amazonia. His colored plates

are good reproductions of living animals in natural settings. With regard to *Cebus*, Cruz Lima (p. 136) found it divisible into "three groups which respectively correspond to the forms *apella*, *capucinus* of authors and *albifrons* of authors." He further remarked that "it is difficult and risky to establish fixed bases for the differentiation of these groups in view of the unknown ranges of individual variation, but any layman who knows the fauna of the Amazon is able to distinguish them at first sight by external appearance. To this end, a method much better than the most detailed descriptions which would necessarily be based on fluctuating characteristics, we publish three plates illustrating the three groups, having used as models living, fully adult specimens, each representing more or less the average form (*apella*, Plate xxii; *nigrivittatus*, Plate xxiii; *gracilis*, Plate xxiv)."

In the text Cruz Lima referred to the work of Elliot, Cabrera, and Tate. He confessed having received Tate's paper too late for critical comparison with his material. Consequently, he included unchanged many of Tate's decisions in his own monograph. Unfortunately, Cruz Lima attempted, either innocently or in a spirit of conciliation, to harmonize his own views with those of the mutually contradictory conclusions of Tate and Cabrera. The unhappy result is that both his key and classification of Amazonian cebids distort his own expressed concepts of the real divisions of *Cebus* and their true interrelationships. The cited plate of *Cebus apella* shows the same animal that Cruz Lima, in accepting Tate's classification, referred to as *fatuellus* in his section dealing with species and subspecies. He copied Tate further by listing *trepidus* as a subspecies of *fatuellus*. His key, which combines cranial characters given by Tate to distinguish "tufted" from "untufted" cebids, and external characters of these monkeys given by Cabrera, shows *apella* as "untufted"! *Cebus nigrivittatus*, correctly figured, is listed as a distinct species, but the key shows it to be "tufted"! *C. albifrons*, *unicolor*, and *gracilis* are each keyed correctly as "untufted" but are listed as distinct species. The figure of *gracilis* [= *C. albifrons unicolor*] shows its subspecific characters admirably well.

#### TAXONOMIC HISTORY OF "UNTUFTED" CEBIDS

***Simia capucina*** Linnaeus (1758, p. 29). The description is indisputably that of an "untufted" *Cebus*. No locality was given, but *capucina* may be the black white-fronted *Cebus* of Central America and western Colombia and Ecuador. The color of the monkey as described and indicated in the wood cut cited by Linnaeus is too dark for any member of the *albifrons* group, while the form of the dark-colored portion of the crown excludes it as a member of the *nigrivittatus* group. Pucheran (1856, p. 34) attempted to identify this species, and Elliot (1907c, p. 227) repeated Pucheran's discussion. The conclusion



of both authors that *Simia capucina* is the black white-fronted cebid may be accepted. Their identification of Buffon's *saï à gorge blanche* and of Humboldt's *hypoleucus* with *S. capucina* is not valid, however.

Other described black white-fronted monkeys are now generally held to be either subspecies or synonyms of *C. capucinus*. These are *imitator* Thomas, *curtus* Bangs, *nigripectus* Elliot, and *limitaneus* Hollister.

***Simia capucina*** Linnaeus (1766, p. 42). The primary reference is the same as for the *Simia capucina* of 1758, viz, "mus. Ad. Fr. 2, t. 2," but the diagnosis is modified and the habitat, Surinam, is added. The next reference is to Brisson's *sapajou brun* ("Regnum Animale," p. 193, 1756). The detailed description that follows has only a superficial resemblance to that of the *sapajou brun*, the original of which was in the museum of M. de Reaumur, in Paris. The Linnaean description may have been based on an actual specimen or, more probably, composed on the basis of mounted specimens and published descriptions. In its totality the 1766 description is certainly not that of the *Simia capucina* of 1758. In certain respects the secondary description could apply to the "tufted" *apella*. In other respects, chiefly by omissions, it could apply to the brown "untufted" monkey that was identified by early post-Linnaean authors as *Cebus capucinus* but that, because of the homonymity, should be known as *C. nigrivittatus*.

Elliot (1907c, p. 227) concerned himself with an attempt to identify the *Simia capucina* of 1766. He concluded that it was the same as *C. apella*, which according to his own description is clearly a "tufted" cebid. He was lamentably confused, however, in asserting that *C. apella* is the same that early authors had inappropriately identified as *C. capucinus*. As is shown in the discussions below, these authors, all more versed than Elliot in the zoology and taxonomy of American primates, had consistently identified the "tufted" *C. apella* as *C. apella* and, sometimes, as *C. fatuellus*, a synonym of *apella*. Thomas (1911, p. 128), in attempting to fix the basis for *C. apella*, referred to Elliot as authority for its identity with *capucinus* of authors. While it may be arbitrary to regard the *Simia capucina* of Linnaeus, 1766, as a synonym of *apella*, the identity of *C. capucinus* of authors with *C. apella* is wholly untenable.

***Cebus capucinus*** Erxleben (1777, p. 48). The genus *Cebus* was here erected to accommodate several Neotropical species of primates including the ceboid *capucinus*, *apella*, *trepidus*, and *fatuellus*. Distinct genera were subsequently created for other species and the genus *Cebus* was left for those named above. No genotype was designated until Elliot (1907a, p. 560) did so by electing *Simia capucina* Linnaeus. The *capucinus* of Erxleben is a composite. It can be "tufted" or "untufted" and brown, black, or gray on back, head, tail, and limbs.



In the synonymy of *capucinus*, Erxleben cited the references to *Simia capucina* Linnaeus 1754 and 1758, as well as the 1766 version of *capucina* and numerous other citations to black, gray, and brown monkeys which he thought differed little, if at all, from *apella*, a "tufted" *Cebus*. However, Opinion 91 of the International Commission on Zoological Nomenclature, which placed "*Cebus* Erxl., 1777, 44, type *Simia capucina* Linn., 1758a, 29" in the official list of generic names, automatically restricts the identification of Erxleben's *capucinus*.

***Cebus capucinus***, of authors. Soon after the generic name *Cebus* was reserved for the species listed above (see *capucinus* Erxleben), the specific name *capucinus* was adopted, erroneously, for the dark brown "untufted" *Cebus* of the Guianas, Venezuela, and northern Brazil. Humboldt (1812, pp. 324–325) described this species, his "Matchi" of Caracas and Calabozo, under the name *Simia capucina* and distinguished it from the "tufted" *apella*. He was soon followed by E. Geoffroy (1812, p. 111), who also used the name *capucinus* for the dark brown "untufted" *Cebus*. Geoffroy included in the synonymy of *Cebus capucinus* the *Saï* of Buffon and of Audebert (fam. 5, sect. 2, pl. 4, 1797), both beyond a shadow of a doubt identical with the animal later described by Wagner as *C. nigrivittatus*. Cuvier (1820, p. 2, pl.) added an excellent colored figure of the dark brown "untufted" *Cebus* with the wedge-shaped coronal cap to the previous ones identified as *Cebus capucinus* by early post-Linnaean authors. Concerning this figure, the *sajou brun femelle*, Cuvier remarked, "C'est sans doute le *Simia capucina* des auteurs systématiques, si mon *Saï* est leur *Simia appella* [sic]." It is clear, however, that the name *capucinus* cannot be applied to the brown "untufted" *Cebus* of authors. Its use is restricted by the original description in 1758 to what is held to be the black white-fronted *Cebus*. It has already been shown, amply and repeatedly, by various authors that the *capucinus* of early post-Linnaean authors is equivalent to the conspecific *nigrivittatus* Wagner and *olivaceus* Schomburgk. This was first indicated by Pucheran (1856, p. 34), then by Schlegel (1876, p. 191), by Cabrera (1917a, p. 227), and finally by Bourdelle and Mathias (1928, p. 188). Again, Cabrera (1939, p. 19) reviewed the history of *capucinus* of authors and affirmed its identity with *C. nigrivittatus* Wagner. Cabrera has gone farther, however, in asserting that *Simia capucina* Linnaeus, 1766, not 1758, must be regarded as the genotype fixed by Elliot (1907a, p. 560). That *capucinus* Linnaeus, 1766, is the same as *capucinus* of early authors is debatable. The primary reference makes it a synonym of *capucinus*, 1758. The secondary reference makes it a homonym, if the animal described is at all identifiable. Elliot, in designating the type of the genus *Cebus* Erxleben, gave only "*Simia capucina* Linnaeus." In his synonymy of *capucinus* as the genotype

he cited Linnaeus, 1758, and Linnaeus, 1766. His other references (not known to Erxleben) make Elliot's *capucinus* a composite of all species of the genus. Erxleben also cited both Linnaean references. His description and synonymy of *capucinus* are equally vague and all inclusive. As Erxleben's *capucinus* has already been restricted (opinion 91) to the original Linnaean, or 1758, reference, it follows that the *capucinus* designated by Elliot as genotype must also be restricted to Erxleben's citation of the same reference, namely, *Simia capucina* Linnaeus, 1758.

***Simia flavia*** Schreber (1774, pl. xxxib). The monkey is figured but not described in the text. The name may be the earliest available one for the *albifrons* group providing the figure could be positively identified as that of a *Cebus*. Except for its nearly white coronal cap, the figure might be identified with some of the paler representatives of the "untufted" group of *Cebus* such as *unicolor* and specimens at hand from dry areas of northern Colombia and from Trinidad. Nothing is known of the place of origin of the type specimen of *flavia*. In all probability the type was a menagerie animal, reared in captivity and with characters so abnormal, or so divergent from those of its nearest relatives in the wild state, that no justice would be done in attempting to compare it with other described forms or with normal individuals. It is here deemed best to agree with Cabrera (1917a, p. 232) in regarding *Simia flavia* as unidentifiable. It may be the same as *Cercopithecus flavus* Boddaert ("Elenchus Animalium," vol. 1, p. 59, 1784) said to be from "Guinea."

***Cebus lugubris*** Erxleben (1777, p. 53). Described as "*Magnitudo Capucini Totus niger. Facies ferruginea, cum circumferentia usque in pedes anticos. Est in viuario Sereniss. Principis Hassiae, Cassellis. Mitis. A nemine descriptus, quantum video.*" Lesson (1840, p. 148) cited *lugubris* in the synonymy of "variété C," of *Cebus capucinus*. However, Erxleben's animal cannot certainly be identified with *C. capucinus* of Linnaeus or of authors, or even as a *Cebus*. Humboldt (1812, p. 335) had already recommended the suppression of the name *lugubris* (also *morta*, *trepida*, and *syrichtha*) as unidentifiable.

**[*Simia*] *Sapajus capucinus albulus*** Kerr (1792, p. 78). Kerr's description of *capucinus* (*sensu stricto*) on the same page is that of a "tufted" *Cebus*, or *C. apella*, and *albulus* is said to agree with it in every respect except by its "having less hair around the face." The complete description of *albulus*, however, is a composite of "tufted" and brown "untufted" cebids. The latter element of the composition is attributable to Kerr's reference to the "Sai with a White Throat" described and figured in Smellie's translation of Buffon's Natural History. The original *saï à gorge blanche* of Buffon and Daubenton is a dark brown pale-fronted *Cebus*, almost certainly the same as *Simia*

*hypoleuca* Humboldt, an *albifrons* (see below). However, authors have heretofore regarded Buffon's (and Smellie's) monkey as a black white-fronted *Cebus* equivalent to *Cebus capucinus* Linnaeus, 1758. Thus, *Simia capucinus albulus* can be confused with any one of three distinct species of *Cebus*. It could be regarded as (1) a variety of *C. apella*, based on Kerr's concept of *capucinus*, (2) a brown pale-fronted *Cebus* (*albifrons*) based on the reference to the "Sai with a White Throat," and (3) a black white-fronted *Cebus* based on the misrepresentation of the *sai à gorge blanche* as such. To avoid this confusion, the name *albulus* is here restricted to Kerr's concept of the species *capucinus*. Hence, *albulus* is either a synonym of *C. apella* or unidentifiable.

The assumption that both the *sai à gorge blanche* and *Simia hypoleuca* Humboldt are black (*capucinus*) rather than brown (*albifrons*) monkeys led Allen (1895, p. 186) to consider *albulus* an earlier name for *hypoleucus*. Pusch (1941, p. 191) identified one black white-fronted *Cebus* from Cartagena, and others without locality data, as *C. capucinus albulus*. This is untenable as *albulus* is not only unidentifiable as a true *capucinus* but its habitat was originally stated to be Brazil. Furthermore, Cartagena is within the range Pusch had already assigned to the typical race of *C. capucinus*.

***Cercopithecus flavus*** Goldfuss (Vergleichende Naturbeschreibung Säugethiere, Abt. 1, p. 74, 1809). The name was exhumed by Pusch (1941, p. 210) as representing a valid subspecies of the later described *albifrons* Humboldt. Pusch added *barbatus* Geoffroy, *Brissonii* Lesson, and "*flavescens* Reichenbach" to the synonymy of *flavus*, which he described as a uniformly pale monkey but with cap and back of head brown. Pusch had only a skull of a menagerie specimen of unknown origin on which to base identification, diagnosis, distribution (Guiana), and synonymy. Goldfuss' publication was not available, but Dr. Remington Kellogg kindly provided the writer with a copy of the original page containing the description of *Cercopithecus flavus*. Here *flavus* is shown as an emended form of the name for "Der Gelbe Halbaffe. *Simia flavia* v. Schreb. suppl. t.51.B." Goldfuss' entire description is derived from the colored plate cited (see *flavia* Schreber, above).

***Simia albifrons*** Humboldt (1812, pp. 324-356). The name here adopted as the earliest valid one for the brown pale-fronted "untufted" *Cebus*. No specimen absolutely identifiable with *albifrons* has ever been recorded. This may be attributable to the absence of topotypes in any museum collection, to some vagaries in the original description, and to the nature of the individual, an animal reared as a pet, on which are based the main elements of the original description. Nevertheless, the original description and comparisons empha-

size the diagnostic characters of *albifrons* and render certain its identification and distinction from any other species of *Cebus*. Furthermore, the name *albifrons* is based on monkeys seen by Humboldt in their native habitat. Thus, it is mandatory to regard the brown pale-fronted *Cebus* of the upper Río Orinoco region as the typical representative of this widely distributed species.

Pusch's treatment of *albifrons* is novel. He gave its distribution as "Rio de Janeiro, Sao Paulo, Bahia." This range not only excludes the type locality but is wholly outside the range of the species. Pusch had no specimens of *albifrons*, but he listed as synonyms of it a miscellaneous collection of "tufted" cebids that have nothing in common with true *albifrons* apart from belonging to the same genus. Pusch's bases for distinguishing "*albifrons*" from all other species of *Cebus* were his observation that other monkeys "arch their backs like cats while *C. albifrons* always maintains its back stiff and straight. It does not seem to climb upward for any great distance. It prefers, instead, a position with its head uppermost. When not grasping anything, *C. apella* always supports itself with its hands while sitting. *C. albifrons*, on the contrary, prefers to lock its arms over its head while in a sitting posture. On the ground, *C. apella chacoensis* and *C. albifrons* walk with a quiet evenly paced gait, while the common *apella* (*griseus* group) scurries about restlessly with its back highly arched. The explanation for this may be that the latter species was better fed and the former feared its superior strength." These compelling arguments for distinction of the species concerned were based on the quoted author's notes on menagerie animals of unknown origins.

***Simia hypoleuca*** Humboldt (1812, p. 336). The original description (reproduced in full under the subspecific heading in this report) is obviously that of a brown pale-fronted *Cebus* of the *albifrons* group. Nevertheless, *hypoleucus* has been considered by most authors as identical with the black white-fronted *C. capucinus* Linnaeus, 1758. This error in identification was initiated and perpetuated by authors who either failed to examine carefully the original description of *hypoleucus* or did not distinguish between the brown *capucinus* of authors and the black white-fronted *capucinus* of Linnaeus, 1758. E. Geoffroy (1812, p. 111) doubtfully referred *hypoleucus* (and Buffon's *saï à gorge blanche*) to his "*capucinus*," the brown species. Subsequent authors, notably Pucheran (1856, p. 34) and Elliot (1907c, p. 227), followed by indiscriminately regarding *hypoleucus* as identical with true *capucinus*! If Humboldt ever saw a true *Cebus capucinus* during the course of his travels in tropical America, he never revealed it in any of his numerous writings. He reviewed all species of *Cebus* known to him, and nowhere throughout the text of his accounts can be found any allusions to a black white-fronted monkey. All cebids described

by Humboldt are of some tone of brown on back and tail. He distinguished *C. apella* from *C. capucinus* of authors (*nigrivittatus*), and *albifrons* from these. The diagnosis of *hypoleucus* emphasizing the great extension of whitish on front of body (face, neck, chest, shoulder, inner and front sides of upper arm, and upper part of lower arm) was intended to distinguish this monkey from other species of the genus. Were *hypoleucus* black instead of brown on upperparts, that alone would have been sufficient for a diagnosis.

The alleged identity of *hypoleucus* with *C. capucinus* led Goldman (1914, p. 99) to fix the type locality of the latter upon that of the former. In doing so no inquiry was made into the true status of *hypoleucus*, and no evidence was produced that black white-fronted cebids really occur in the region of the mouth of the Río Sinú. No such evidence exists to this day, but it is highly probable that both black and brown cebids do occur there. This probability has, undoubtedly, contributed in large measure to the assumption that *hypoleucus* and *capucinus* are identical.

To be different, Pusch (1941, p. 191) recognized *hypoleucus* as a valid subspecies of *capucinus* Linnaeus. Its range, on the basis of localities of specimens he assigned to *hypoleucus* (such locality records and his "Verbreitung" and the distributional maps of the forms he recognized do not always agree), is essentially the same as the one he gave to typical *capucinus*. To emphasize impartiality in regarding *capucinus* and *hypoleucus* as races of equal status living happily side by side, Pusch listed the female type and paratype of *imitator* Thomas in the synonymy of the first, and the male paratype in the synonymy of the second. In the same spirit, he apportioned three specimens of a series of five collected by Watson in Boquete, Panamá, to *capucinus* and the remaining two specimens to *hypoleucus*. Pusch did record a hybrid, without locality, not of *hypoleucus* and *capucinus*, as might be expected, but, strange as it may seem, of *hypoleucus* and the middle Amazonian *gracilis*.

**Cebus barbatus** Humboldt (1812, p. 356). See discussion below, of *barbatus* Geoffroy.

**Cebus fulvus** Humboldt (1812, p. 356). See discussion, below, of *fulvus* Geoffroy.

**Cebus barbatus** E. Geoffroy (1812, p. 110). On the basis of the original description alone, this form could be termed unidentifiable (cf. Cabrera, 1917a, p. 231). There is a mounted specimen in Paris, however, designated as the "type." It is No. 561 of the type catalog and No. 453 of the general collection of the Paris Museum (I. Geoffroy, 1851, p. 45; Rode, 1938, p. 231). The specimen was received through exchange from Temminck in 1812. The right side of body and tail is faded to dirty gray; on the left side the body is yellow, legs and

arms redder, tail dirty brown. The pelage is thick and curly. Seemingly the skin was not properly relaxed for mounting, and as a result the hair assumed curls and whorls that may have formed in the dry twisted and unprepared skin. The specimen is clearly that of an "untufted" *Cebus*, more probably of the *albifrons* than of the *nigrivittatus* group. It was said to have originated in the Guianas, but the specimen itself is without locality data. Geoffroy's synonymies make *barbatus* a composite species, since he cited the *sajou gris* of Buffon and Daubenton, a "tufted" *Cebus* (*C. apella*),<sup>1</sup> and the "*Saï* Var. A. Aud., *fam.* 5, sec. 2, fig. 6." The cited figure 6 belongs to the *Saï variété* B of Audebert, not *variété* A as given by Geoffroy. Cabrera (1917a, p. 227) identified the *saï variété* B of Audebert as *C. olivaceus*, here treated as a race of *C. nigrivittatus*. Desmarest (1820, p. 81) recognized the composite nature of Geoffroy's description and named the *sajou gris*, *Cebus griseus*. He then listed the restricted *C. barbatus* of Geoffroy with the reference to Audebert's figure 6, as a distinct species. This procedure appears justifiable, as neither the type specimen of *barbatus* nor the cited figure of Audebert is the same as the *sajou gris* of Buffon and Daubenton. Unfortunately, Desmarest's description is also composite. In addition to the *sajou gris*, he cited the *sajou mâle* of Cuvier (1819, pl.). This last is an "untufted" *Cebus* representing an extremely pale variety of *C. nigrivittatus*. The embroiled nomenclature of the above forms may be set forth more clearly in the following summary:

1. The lectotype of *C. barbatus* Geoffroy, perhaps from the Guianas, is an "untufted" *Cebus* but otherwise unidentifiable. Its name is preoccupied by *C. barbatus* Humboldt.

2. Humboldt cited only the *sajou gris* as a basis for the name *barbatus*. Consequently, *C. griseus* Desmarest, based primarily on the *sajou gris* of Buffon and Daubenton, is an absolute synonym of *barbatus* Humboldt and both are equal to *Cebus apella* Linnaeus. No locality for either *barbatus* or *griseus* was given.

3. If Kerr's names are valid, as they appear to be, then both *barbatus* Humboldt and *griseus* Desmarest are antedated by *Simia* (*Sapajus*) *trepidus fulvus*, based strictly on the *sajou gris*. Allen (1895, p. 186) has shown *fulvus* Kerr to be a synonym of *C. apella*.

***Cebus flavus*** E. Geoffroy (1812, p. 111). This is probably an "untufted" *Cebus*. Beyond this, *flavus* is not certainly identifiable. The monkey, listed by Rode (1938, p. 231) as "Holotype," No. 562

<sup>1</sup> The original figure of the *sajou gris* (1767, pl. V) is hardly identifiable. The description (p. 50), however, states clearly one external character of the "tufted," or *apella* group, which is diagnostic, the black tipped hairs that "fermoit une bande sur chaque joue." In Buffon and Daubenton the *sajous* are equivalent to the "tufted" *Cebus*, the *saïs* to the "untufted." Cabrera (1917a, p. 231) also quoted the description, but at greater length, to prove that the *sajou gris* cannot be identified with *albifrons*, *olivaceus*, or *nigrivittatus*. Latreille (in Buffon, *Hist. Nat.*, Sonnini ed., vol. 36, p. 280, 1804) saw the types of Buffon's *sajou gris* and *sajou brun* "vivans à la ménagerie du muséum français." He assigned both to his *Callithrix apella* (= *Simia apella* Linnaeus).



(458), was brought to the Paris Museum from Lisbon, presumably in its present state, a mounted specimen with skull in skin. The individual is extremely faded with considerable portions of hair of underparts, head and face missing. It is said to have originated in Brazil. Being based on an actual specimen, *flavus* Geoffroy is not strictly the same as *flavia* Schreber, though the latter was cited in the description of the former. *Cebus flavus* may be identical with *C. gracilis* (= *unicolor*), also from Brazil, as Wagner (1855, p. 90) suggested. In any case, the question remains whether the specimen determined as *flavus* by Geoffroy is to be regarded as a type or simply as a specimen referred to the amended form of the name *flavia* Schreber.

For some unknown reason the name *flavus*, or *flavia*, was prone to nomenclatorial accidents. Humboldt, in referring to Geoffroy's *flavus*, wrote it as "*Cebus fulvus*." This is a *nomen nudum*, as nothing that can be construed as a description accompanies this name, which appeared in published form a few months earlier than did the *flavus* of Geoffroy. Desmarest (1820, p. 83), because of a typographical error pointed out by I. Geoffroy (1851, p. 44), also listed *flavus* as *fulvus*. However, an earlier use of the name *fulvus* was made by Kerr (1792, p. 77), who described *Simia (Sapajus) trepidus fulvus*, a "tufted" *Cebus*. Elliot (1913, p. 93) used *flavus* Geoffroy to replace the name *barbatus*, which has priority over it, and Pusch (1941, p. 193) listed *flavus* Geoffroy as a synonym of *versicolor*!

***Cebus albus*** E. Geoffroy (1812, p. 111). A complete albino. It was described as either a new species or as simply an albinistic variety. It has been variously considered a synonym of *flavus* and *barbatus*. Cabrera (1917a, p. 232) properly dismissed *albus* as unidentifiable.

***Cebus griseus*** Desmarest (1820, p. 81). See discussion, above, of *barbatus* Geoffroy.

***Cebus fulvus*** Desmarest (1820, p. 83). See discussion, above, of *flavus* Geoffroy.

***Cebus unicolor*** Spix (1823, p. 7, pl. 4). Described from Teffé, Rio Solimões. The type is a male and, judged from the description and colored figure, is a member of the *albifrons* group.

***Cebus gracilis*** Spix (1823, p. 8, pl. 5). From the same locality as *unicolor*. It is said to range from "la ville de Rio Negro vers le Perou." The description and figure of *gracilis*, apparently that of a female, differ little from those of *unicolor*. In fact, the differences are no greater than may be observed between two individuals of the same series but of different age and sex. Specimens recorded by Tate (1939, p. 213), from the upper Rio Negro and the Casiquiare, as *C. albifrons* show a remarkably close resemblance to both *gracilis* and *unicolor* and may be classified as *C. albifrons unicolor*. Authors have generally used the name *gracilis* instead of *unicolor* which has page priority, for the brown white-fronted *Cebus* of the Amazonian region.



**Cebus chrysopus** Lesson (1827, p. 55). Based on the "*sajou à pieds dorés ou chrysope*" of F. Cuvier (1825, pl., 2 pp.). The specific name "*Chrysopes*" as originally proposed by Cuvier (text, end of second page) is nonbinomial; hence the use of Lesson's *Cebus chrysopus* as the earliest acceptable designation. The original description was based on a living menagerie monkey that Cuvier was able to observe for a few days. The type was not preserved. It was said to have originated in "l'Amérique septentrionale." I. Geoffroy (1829, p. 150) recorded specimens of *Cebus*, collected by Plée, under the name *chrysopus*. Plée had done some collecting along the banks of the Río Magdalena, Colombia, and Geoffroy's description fits the available specimens of *Cebus* from the west bank of that river, opposite the mouth of the Río Cesar. These monkeys, however, differ in many respects from the description and colored figure of Cuvier's *sajou à pieds dorés*. Geoffroy was followed by others, notably Lesson (1838, p. 277), Schlegel (1876, p. 195), and Elliot, in referring the Plée specimens to *chrysopus* either as a distinct species or as a synonym of *C. albifrons*. Elliot listed the Plée specimens separately under *albifrons* and a few pages later (1913, p. 99) described them as representatives of *chrysopus*. Cabrera (1900, p. 78) and Lönnberg (1939, p. 23) saw some resemblance between specimens from the Amazonian region and the colored figure of the *sajou à pieds dorés*. Goeldi and Hagmann (1904, p. 48) synonymized both *chrysopus* and *gracilis* Spix (= *unicolor* Spix) with *Cebus albifrons* on the basis of specimens believed to have originated in the upper Amazonian region. In his review of the species of the genus *Cebus*, Cabrera (1917a, p. 229) finally decided that *chrysopus* was probably natural to the tropical Colombian fauna, perhaps of the Cauca-Magdalena Valley. It can now be stated categorically that no *Cebus* agreeing with the description of *chrysopus*, with ample allowances for individual variation, occurs in the Cauca-Magdalena Valley or elsewhere in Colombia from which specimens of the *albifrons* group are at hand. On the other hand, the original figure of *chrysopus* shows greatest resemblance to Amazonian specimens referred to *C. albifrons unicolor*. As it is unlikely that the menagerie animal representing *chrysopus* can ever be positively identified with any wild living representatives of *C. albifrons*, it is best to relegate provisionally that name to the synonymy of *unicolor*.

**Cebus Brissonii** Lesson (1840, p. 155). The first reference in the description is "*Simiolus ceylonicus*, Seba, t. 1, p. 77, pl. 48, fig. 3." Next is given the *Cercopithecus flavus* of Brisson (1762, p. 140) with the original Latin diagnosis quoted. These citations are followed by references to forms described or transcribed as *flava* [sic] Schreber, *flavus* Geoffrey, and *fulvus* Desmarest. The Seba and Brisson animals are probably the same, as Brisson also cited Seba. The monkey in

question may be a *Saimiri*. Humboldt (1812, p. 310) identified it as a *Pithecia*. In any case, *Cebus Brissonii* Lesson is preoccupied by *Cebus Brissonii* Fischer, 1829, an *Ateles*. Elliot (1913, p. 93) listed *brissonii* as a synonym of *Cebus flavus* Geoffroy, and Pusch (1941, p. 210) included it in the synonymy of "*C. albifrons flavus* Goldfuss."

***Cebus versicolor*** Pucheran (1845, p. 335). Described as very nearly related to *chrysopus*. The type locality was given as "Santa-Fe de Bogota," Colombia. The name is applicable to the brown pale-fronted monkeys of the middle Río Magdalena Valley.

***Cebus nigrivittatus*** Wagner (1848, p. 430). Based on specimens collected by Natterer and described by him in his unpublished notes. Pucheran (1857, p. 346) examined the type of *nigrivittatus* and compared it with *versicolor*. Schlegel (1876, p. 193), in discussing the identity and characters of "*Cebus capucinus* Geoffroy," indicated that *C. nigrivittatus*, as well as *castaneus* and *olivaceus*, is representative. The name *nigrivittatus*, adopted for the misnomer *capucinus* Linnaeus, 1766 (not 1758), may require revision if it can be shown that the conspecific *olivaceus* antedates it. Though frequently cited for the year 1847, the name *nigrivittatus* did not appear until 1848, the same year in which the description of *olivaceus* was published in the second volume of Schomburgk's "Reisen."

Both Schlegel (*op. cit.*) and Cabrera (1917a, p. 227; 1924, p. 131) considered the *sajou mâle* and the *sajou brun femelle* of Cuvier identical with *capucinus* of authors, or *nigrivittatus*. While the *sajou brun* is clearly the monkey known as *capucinus* of authors, the *sajou mâle* is difficult to identify with certainty. Its head, especially the form of the coronal cap, is like that of *nigrivittatus*; the color of the remainder of the body, however, resembles that of an *albifrons*. This composite appearance is actually a common occurrence among menagerie monkeys. Desmarest based the name *Cebus griseus* (q. v.) partially on the *sajou mâle* but primarily on the *sajou gris* of Buffon. Hence, the name *griseus* is not available for *capucinus* of authors. Reichenbach employed the name *paraguayanus* for the *sajou mâle*. However, Reichenbach's name is not only preoccupied by *paraguayanus* Fischer but is antedated by *nigrivittatus* Wagner as well. Pelzeln (1884, p. 11) identified *capucinus* of authors with *Cebus nigrivittatus* and added that the type of the latter was purchased from the Porocoto Indians in San Joaquim, upper Rio Branco.

***Cebus olivaceus*** Schomburgk (1848, pp. 246, 247). As originally described, and as appears in a topotype from Mount Roraima, *olivaceus* is a local form of *C. nigrivittatus*. Cabrera (1917a, p. 227) believed it to be closely related but specifically distinct from *nigrivittatus*. He had no specimens and arrived at this conclusion indirectly by assuming that *olivaceus* was the same as the *saï variété B* of Audebert. This

last may be identified as a pale race of *nigrivittatus* not necessarily *olivaceus*. Pucheran (1856, p. 34), in attempting to identify *capucinus* of authors, not Linnaeus, concluded that it was equivalent to *olivaceus*. He also called attention to the figure of "*olivaceus*" given by Wagner in supplementary volume 5 (1855, pl. 8), which he believed to be the same as *C. castaneus* I. Geoffroy. The figure in question is that of a pale representative of *nigrivittatus*, "angeblich aus Colombien." Later, Pucheran (1857, pp. 345, 352) modified his opinion. He thought, instead, that *olivaceus* and *castaneus* were the same but distinct from *capucinus* of authors (*nigrivittatus*). This reversal appears to have been a friendly gesture to Dahlbom, who had already bestowed the name *pucheranii* (q. v.) upon the *capucinus* of authors. The name *olivaceus* was published in the same year as *nigrivittatus*.

**Cebus castaneus** I. Geoffroy (1851, p. 46). A representative of *nigrivittatus* nearest, perhaps, to *olivaceus*. The type, sent from Cayenne in 1819, was mounted and now is in very poor condition. On the assumption that the monkey originated somewhere along the coast of French Guiana, it could hardly be synonymized with *olivaceus*, which, according to Schomburgk, does not occur anywhere below 3,000 feet in the Mount Roraima region. It most probably is the same as the British Guianan *Cebus* identified by Elliot and by Tate as *Cebus apella apella*.

**Cebus Pucheranii** Dahlbom (1856, pp. 161, 165). A new name for the "Ce. capucinus Is. Geoff. St. Hil. non Linnaei. America meridional." The name was proposed in honor of Pucheran, who "Simian capucinum Lin. a Cebo capucino Is. Geoffr. primus rite distinxit." References to Pucheran's views are given in the above discussions of *capucinus* and *olivaceus*. This last name, and *nigrivittatus*, have priority over *pucheranii* for *capucinus* of authors. It will be noted, incidentally, that the description of *pucheranii* is included by Dahlbom in his "tufted" group. Hence, the name is in no case valid for that part of *capucinus* I. Geoffroy which is of authors but could apply to the three "tufted" menagerie specimens listed by I. Geoffroy (1851, p. 46) under the name *capucinus*.

**Cebus paraguayanus** Reichenbach (1862, p. 41, fig. 118). The description and figure are based on the brown "untufted" *sajou mâle* of Cuvier, while the name is taken from Fischer's *Cebus apella paraguayanus*, equivalent to Azara's "cay," a "tufted" form. Cabrera (1939, p. 34) discussed this subject fully showing the untenability of the name proposed by Reichenbach.

**Cebus leucocephalus** Gray (1865, p. 827, fig. 4). A member of the *albifrons* group and generally considered a synonym of *versicolor*. However, *leucocephalus* is distinctly darker than *versicolor* and, apparently, representative of the dark brown *albifrons* of northeastern

Colombia and western Venezuela. This has been shown by Osgood (1910, p. 32). Additional material together with the writer's notes on the type bear out Osgood's conclusions. The "*leucocephalus* Blainville" cited by Elliot (1913, p. 88) and by Tate (1939, p. 214) as conspecific with *Cebus albifrons* is *Pithecia leucocephala* Geoffroy and not *Cebus leucocephalus* Gray.

***Cebus flavescens*** Gray (1865, p. 827). Elliot (1913, p. 91) disposed of the name *flavescens* in the synonymy of *unicolor*, and there is no reason for disputing his argument for doing so. Thomas (1901, p. 180) declared that "there seems to be some evidence that it [*flavescens*] has been obtained by Wallace on the Rio Negro."

***Cebus flavescens cuscinus*** Thomas (1901, p. 179). The southernmost representative of the *albifrons* group.

***Cebus apiculatus*** Elliot (1907b, p. 292). A possibly valid race of *nigrivittatus*.

***Cebus malitiosus*** Elliot (1907c, p. 230). A dark race of *albifrons*.

***Cebus apella brunneus*** Allen (1914, p. 653). A weakly differentiated race of *nigrivittatus*.

***Cebus aequatorialis*** Allen (1914, p. 654). A subspecies of *albifrons*.

***Cebus capucinus trinitatis*** Pusch (1941, p. 194). A valid insular race of *C. albifrons*.

***Cebus capucinus leporinus*** Pusch (1941, p. 195). A new name proposed for *Cebus nigrivittatus* Wagner "preoccupied" by *Chrysothrix nigrivittatus* Wagner. The latter is a *Saimiri*, a genus that Pusch recklessly lumped with *Cebus*. As this system of classification is not adhered to in this report, *leporinus* revolves to the synonymy of *nigrivittatus*.

#### SUMMARY OF NAMES DISCUSSED, WITH A LIST OF RECOGNIZABLE SPECIES AND SUBSPECIES

##### UNIDENTIFIABLE

*Simia capucina* Linnaeus, 1766—also a homonym of *capucina* Linnaeus, 1758; designated as genotype of *Sapajus* Kerr, by Kellogg and Goldman (1944, p. 2).<sup>2</sup>

*Simia flavia* Schreber, 1774.

*Cebus lugubris* Erxleben, 1777.

*Cercopithecus flavus* Goldfuss, 1809—same as *flavia* Schreber, emended. Also preoccupied by *Cercopithecus flavus* Boddaert, 1784.

*Simia capucinus albulus* Kerr, 1792.

*Cebus barbatus* Geoffroy, 1812—also a homonym of *barbatus* Humboldt, 1812.

*Cebus flavus* Geoffroy, 1812—same as *flavia* Schreber emended?

*Cebus albus* Geoffroy, 1812.

<sup>2</sup> *Cebus apella* Linnaeus had already been designated as genotype of *Sapajus* Kerr, by Pusch (1941, p. 197).

*Cebus fulvus* Humboldt, 1812—*nomen nudum*, also preoccupied by *fulvus* Kerr.

*Cebus fulvus* Desmarest, 1820—*lapsus calami* for *flavus* Geoffroy, also preoccupied by *fulvus* Kerr.

*Cebus Brissonii* Lesson, 1840—also a homonym of *Cebus Brissonii* Fischer, an *Ateles*.

"TUFTED" CEBIDS FREQUENTLY IDENTIFIED AS "UNTUFTED"

*Sajou gris*, Buffon and Daubenton, 1767.

*Simia capucinus albulus* Kerr, 1792—if identifiable, a synonym of *Cebus apella*.

*Cebus barbatus* Humboldt, 1812—antedated by *fulvus* Kerr, a synonym of *C. apella*.

*Cebus griseus* Desmarest, 1820—antedated by *barbatus* Humboldt and *fulvus* Kerr, all based on the *sajou gris*.

*Cebus Pucheranii* Dahlbom, 1856.

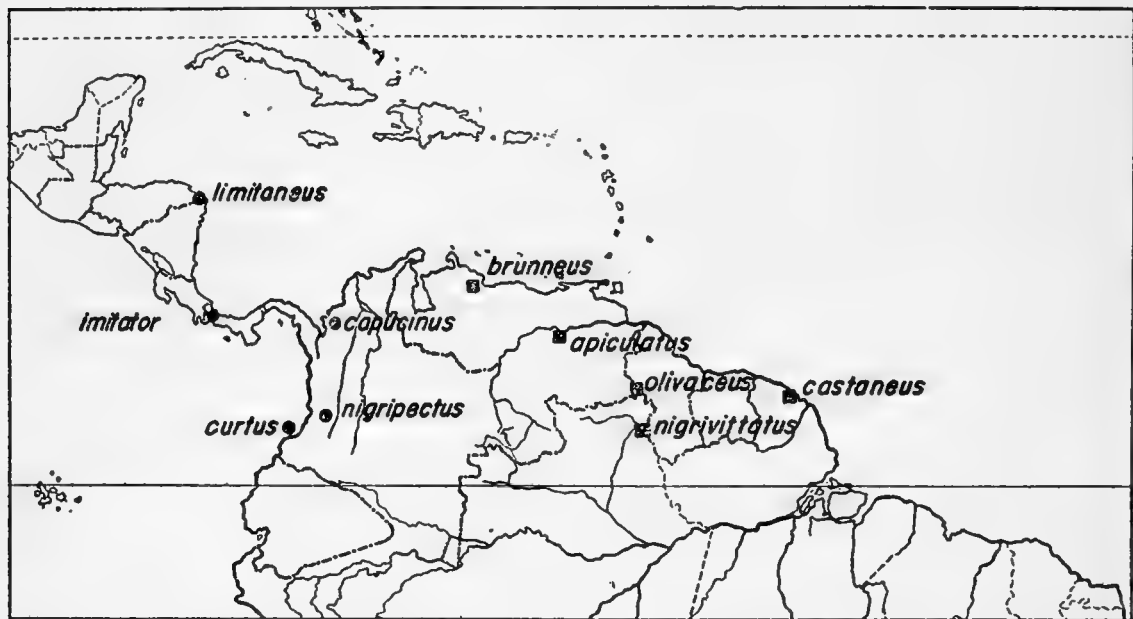


FIGURE 53.—Type localities of the nominal subspecies of *Cebus capucinus* (circles) and of *Cebus nigrivittatus* (squares). See text for names of localities and distribution of the species.

**CEBUS CAPUCINUS Linnaeus**

*Simia capucina* LINNAEUS, 1758 (not 1766)—genotype of *Cebus* Erxleben, by opinion 91, International Commission on Zoological Nomenclature.

*Cebus capucinus*, Erxleben, 1777—identity automatically restricted by opinion 91.

*Simia capucina* v[ariété] a, Audebert, 1797, fam. 5, sect. 2, pl. 5. (*Le Saï à gorge blanche variété A.*)

*Cebus hypoleucus, auctorum* (nec Humboldt).

*Cebus capucinus albulus*, Pusch (nec Kerr).

**Distribution** (map, fig. 53).—From Honduras south into western Colombia and western Ecuador.

None of the distinguishing characters attributed to the described

rices of *C. capucinus* appears to be valid. It is desirable, however, to retain these named subdivisions of the species pending a thorough study of ample material. The following subspecies, with their type localities given, are tentatively recognized:

**CEBUS CAPUCINUS CAPUCINUS Linnaeus**

*Simia capucina* LINNAEUS, *Systema naturae*, ed. 10, p. 29, 1758.

*Type locality*.—Unknown. Fixed by Goldman (1914, p. 99) on that of *hypoleucus* Humboldt, or "northern Colombia." Actually the type locality of *hypoleucus* is the region about the mouth of the Río Sinú. Until it can be positively ascertained, however, that true *capucinus* does occur at the Sinú, the broader restriction to "northern Colombia" should be the one accepted.

**CEBUS CAPUCINUS CURTUS Bangs**

*Cebus curtus* BANGS, *Bull. Mus. Comp. Zool.*, vol. 46, p. 91, 1905.

*Type locality*.—Gorgona Island, Colombia.

**CEBUS CAPUCINUS NIGRIPECTUS Elliot**

*Cebus capucinus nigripectus* ELLIOT, *Bull. Amer. Mus. Nat. Hist.*, vol. 26, p. 229, 1909.

*Type locality*.—Originally given as "Las Pubas, Cauca Valley, Colombia." The type specimen was collected June 13, 1898, by J. H. Batty at Pavas, on the western slope of the Cordillera Occidental between Cali and Buenaventura, Department of Valle del Cauca, altitude 4,500 feet.

**CEBUS CAPUCINUS IMITATOR Thomas**

*Cebus imitator* THOMAS, *Ann. Mag. Nat. Hist.*, ser. 7, vol. 11, p. 376, 1903.

*Type locality*.—Boquete, Chiriquí, Panamá.

**CEBUS CAPUCINUS LIMITANEUS Hollister**

*Cebus capucinus limitaneus* HOLLISTER, *Proc. Biol. Soc. Washington*, vol. 27, p. 105, 1914.

*Type locality*.—Originally given as "Segovia River, eastern Honduras." The Río Segovia (or Wanks) flows between northern Nicaragua and southeastern Honduras. The type specimen was collected in 1887 by C. H. Townsend, who touched the coast of Honduras at points including Trujillo, Patuca, and the mouth of the Río Segovia. Accordingly, the type locality of *Cebus capucinus limitaneus* is here restricted to Cabo Gracias a Dios at the mouth of the Río Segovia, eastern border between Honduras and Nicaragua.

**CEBUS NIGRIVITTATUS Wagner**

*Sai* BUFFON, 1767.

*Simia capucina*, AUDEBERT, 1797 (*nec* Linnaeus), fam. 5, sect. 2, pl. 4 (*Le Sai*).

*Simia capucina* v. B. AUDEBERT, 1797, fam. 5, sect. 2, pl. 6 (*Le Sai Variété B*).

- Sajou mâle*, CUVIER, 1824, livr. 12, pl., November 1819 (*Cebus griseus* F. Cuvier).  
*Sajou brun femelle*, CUVIER, 1824, livr. 16, pl., May 1820.  
*Cebus capucinus*, *auctorum* (Humboldt, Geoffroy, Cuvier, Pucheran, Schlegel, etc., not Linnaeus).  
*Cebus nigrivittatus* WAGNER, 1848; Schlegel, Pelzeln, Cabrera, Bourdelle, and Mathias.  
*Cebus olivaceus* SCHOMBURGK, 1848.  
*Cebus castaneus* I. GEOFFROY, 1851.  
*Cebus paraguayanus* REICHENBACH, 1862.  
*Cebus apiculatus* ELLIOT, 1907.  
*Cebus apella*, ELLIOT, 1913, part (references to any of above in synonymy of *apella*).  
*Cebus apella brunneus* ALLEN, 1914.  
*Cebus apella*, TATE, 1939, part (*apella*, *olivaceus*, *apiculatus*, and *brunneus*).  
*Cebus capucinus*, PUSCH, 1941, part (*olivaceus*, *leporinus*).

*Distribution* (map, fig. 53).—Venezuela, the Guianas, and in Brazil the territory embraced by the lower Amazonas and the Rio Negro.

The following subspecies of *Cebus nigrivittatus* are provisionally recognized:

**CEBUS NIGRIVITTATUS NIGRIVITTATUS** Wagner

- Cebus nigrivittatus* WAGNER, Abh. math.-phys. Cl. bayer. Akad. Wiss., vol. 5, p. 430, 1848.

*Type locality*.—San Joaquim, upper Rio Branco, Amazonas, Brazil.

*Remarks*.—The *Saï* of Buffon and Audebert and the *sajou brun femelle* of Cuvier probably represent the typical form. *C. capucinus leporinus* Pusch is a synonym.

**CEBUS NIGRIVITTATUS OLIVACEUS** Schomburgk

- Cebus olivaceus* SCHOMBURGK, Reisen in British-Guiana, vol. 2, p. 246 (description), p. 247 (name), 1848.

*Type locality*.—Vicinity of "Our Village," said to be situated at latitude 4°57' N., 61°1' W., altitude 3,100 feet above sea level, southern foot of Mount Roraima, Venezuela. The locality may be the same as Paulo, 7 miles southwest of the cliffs of Roraima.

**CEBUS NIGRIVITTATUS CASTANEUS** I. Geoffroy

- Cebus castaneus* I. GEOFFROY, Cat. Meth. Coll. Mamm. Coll. Oiseaux, Coll. Annexes, Paris, p. 46, 1851.

*Type locality*.—Cayenne, French Guiana.

*Remarks*.—*Le Saï variété B* of Audebert agrees most with the type. Specimens from British Guiana recorded by Tate as *Cebus apella* average darker but are best assigned to *castaneus*.

**CEBUS NIGRIVITTATUS APICULATUS** Elliot

- Cebus apiculatus* ELLIOT, Ann. Mag. Nat. Hist., ser. 7, vol. 20, p. 292, 1907.

*Type locality*.—La Unión, Río Caura, near its confluence with the Orinoco, Venezuela.



## CEBUS NIGRIVITTATUS BRUNNEUS Allen

*Cebus apella brunneus* ALLEN, Bull. Amer. Mus. Nat. Hist., vol. 33, p. 653, 1914.

*Type locality*.—Aroa (Pueblo Nuevo), station on the Bolívar Railway, Yaracuy, northwestern Venezuela, altitude 730 feet.

*Remarks*.—One specimen (U.S.N.M. No. 261319) from the Paría Peninsula, Venezuela, is distinctly paler and resembles more nearly the figure of the *Sajou mâle* of Cuvier than any other specimen examined.

## CEBUS ALBIFRONS Humboldt

*Saï à gorge blanche* BUFFON (*nec auctorum*).

*Simia albifrons* HUMBOLDT, 1812.

*Simia hypoleuca* HUMBOLDT, 1812 (*nec auctorum*).

*Cebus unicolor* SPIX, 1823.

*Cebus gracilis* SPIX, 1823.

*Sajou à pieds dorés* or "*Chrysopes*" CUVIER, 1825.

*Cebus chrysopus* LESSON, 1827.

*Cebus versicolor* PUCHERAN, 1845.

*Cebus leucocephalus* GRAY, 1865.

*Cebus flavescens* GRAY, 1865.

*Cebus flavescens cuscinus* THOMAS, 1901.

*Cebus malitiosus* ELLIOT, 1907.

*Cebus aequatorialis* ALLEN, 1914.

*Cebus capucinus trinitatis* PUSCH, 1941.

(Other synonymies given in the subspecies accounts.)

*Distribution* (map, fig. 54).—Amazonian region of Brazil, Colombia, Venezuela, Ecuador, and Peru; banks of upper Río Orinoco and the Lake Maracaibo drainage basin in Venezuela and Colombia; lower Sinú, Ranchería, and Cauca-Magdalena drainage areas of Colombia; Pacific drainage areas of northwestern Ecuador; island of Trinidad. Altitudinal range from sea level to not over 2,000 meters above.

There is no evidence that members of the species exist in northern Venezuela outside the Lake Maracaibo Basin. Micos of this area may be regarded as representing an extension of range of the fraction of the species occupying the Cauca-Magdalena and Ranchería drainage areas of Colombia. *C. albifrons leucocephalus* has a trans-Andean distribution. It ranges from the Río Zulia, an affluent of Lake Maracaibo, across the Cordillera Oriental to the Magdalena Valley. The race of the eastern base of the Sierra de Perijá, Venezuela, probably grades into *malitiosus* of the Sierra Nevada de Santa Marta, Colombia. Immediately south of where the range of these two forms may meet is the region of the Río Cesar, inhabited by a third race. So far as available records show, there is no contiguity between the range of that part of the species mentioned above and that of representatives of the species known to occur in the upper Río Orinoco and in the Amazonian regions. Nevertheless, the former must have been derived from the latter, and the distributional gap may be more

apparent than real. Little or no collecting has been done in most of the area representing the hiatus. The insular *C. a. trinitatis* is completely cut off from its relatives by the northern portion of Venezuela. It may have been introduced into Trinidad from Brazil or from the interior of Venezuela or Colombia. *C. a. aequatorialis* of western Ecuador is also, apparently, a completely isolated race. However, a continuous distribution of the species along the coast of western Colombia between the type localities of *aequatorialis* and *hypoleucus* of northern Colombia may be postulated. If this assumption proves wrong, the probability of an erstwhile low elevation trans-Andean continuity of range between *aequatorialis* and upper Amazonian representatives of *albifrons* must be considered. In spite of the broken distributional pattern of the species, physical characters of the forms referred to *albifrons* are such as to leave no doubt of their conspecificity.

*Coloration*.—Face with light down of brown to silvery hairs, longer hairs sparsely covering upper lip; cheeks and point of chin white to cinnamon. Superciliary region broadly whitish to cinnamon, the color extending round sides of face, encircling ears and continuous with white or ochraceous of throat, sides and ventral surface of neck, upper portion of chest, and part of shoulder. In males, and females without frontal diadem, cap grayish brown to dark brown, usually darker than median dorsal area, broadly outlined in front and often with a median point or line extending across whitish superciliary region. Back from Light Ochraceous-Buff to reddish brown, the hairs usually without sharply contrasted annulations or distinct subterminal banding; median dorsal region usually warmer or darker than sides of back. Lateral fringe like side or middle of back. Lower part of chest and belly sparsely haired yellowish to reddish. Color of upper arm like adjacent regions of shoulder, neck and side of trunk; forearm drab or yellowish to reddish brown, the hairs paler basally, frequently broadly paler or silvery apically, creating a "hoar-frosted" effect. Hands above grayish to dark brown, not black. Thighs like adjacent parts of body; forelegs and feet like forearms and hands. Upper proximal portion of tail like median dorsal region, or "hoar-frosted," terminally paler, undersurface like sides of back proximally, terminally paler, becoming yellowish or whitish.

*Variations*.—The subspecies are differentiated on the basis of color and color pattern; color of limbs, especially in relationship to that of the trunk, is one of the more important diagnostic characters. These characters are fairly constant in any one series of adults irrespective of age and sex. Usually subadults and young individuals show paler tones of the same colors distributed in approximately the same way as in adults. Sexual differences and what appear to be light and dark

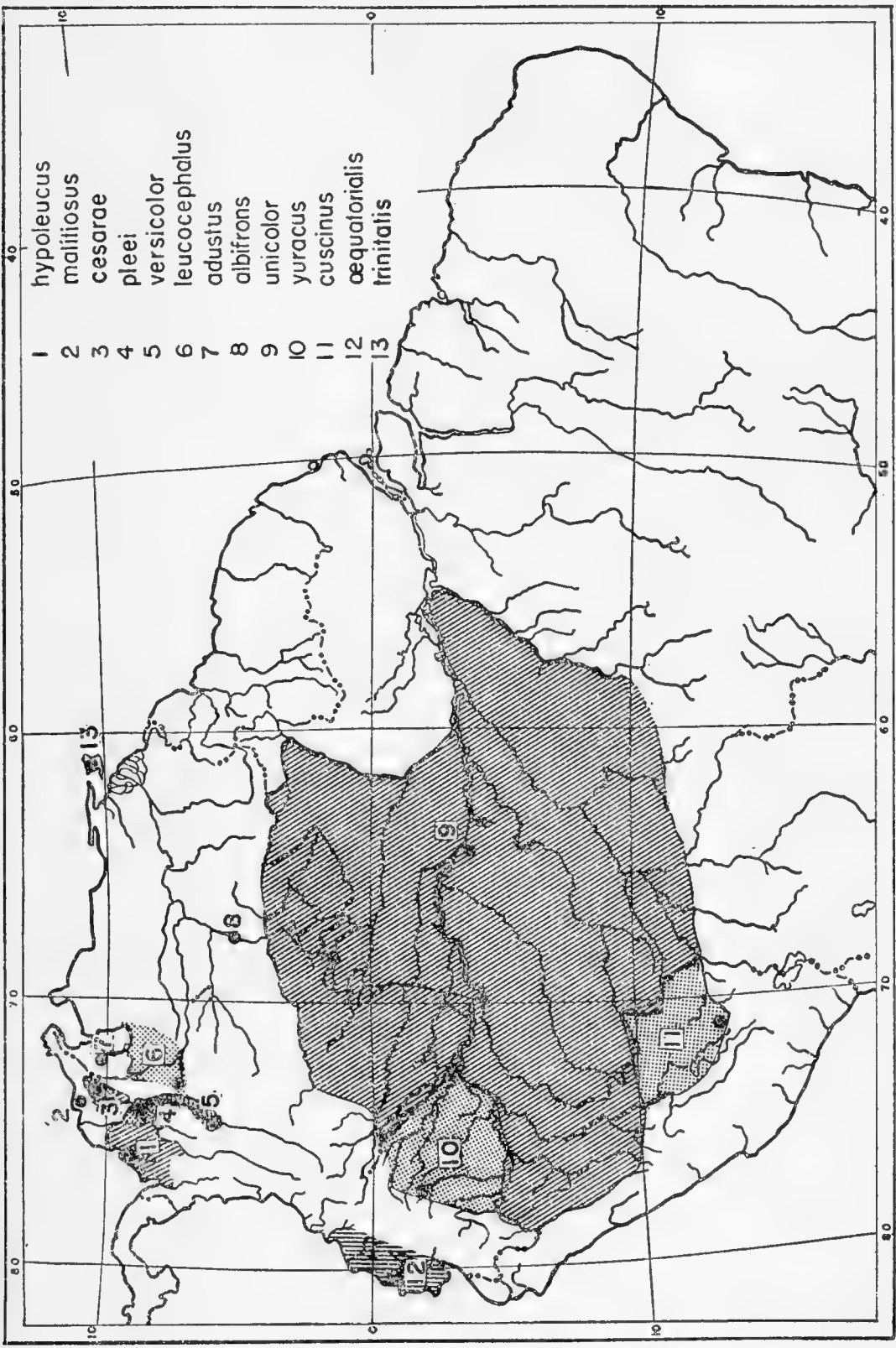


FIGURE 54.—Distribution of *Cebus albifrons*. Range shown for each of the subspecies is a rough approximation. Black circles indicate positions of type localities.

color phases in any one series are strictly comparable with such differences in any other series. Descriptions of coloration of the races are based on the superficial aspects of individuals. The terminal halves of the hairs, usually consisting of one, sometimes two, color bands, are described as determining the color of the individual or population. The color of the basal halves of the hairs, which normally grade into the color of the terminal or subterminal portions, is so variable in any one individual as well as series that it has been completely discounted for diagnostic and even descriptive purposes. Group assemblages known as bands or clans have each some distinctive character which sets them off from other populations. In the absence of samples of intergrading populations, it is difficult to assess the characters which unite clans into geographic races.

External measurements and cranial characters reveal nothing to aid in distinguishing the races. Here factors of age and sex obscure whatever diagnostic differences may exist. Reduction of the mass of available material into comparable individuals yields too few specimens for satisfactory analyses of cranial characters. What does appear is that differences in size and cranial parts are entirely individual.

Present material reveals no indication of geographic gradients or clines, or any close or consistent correlation between coloration of the various populations and their respective habitats. Often representatives of the same species occupying opposing banks of a river where ecological conditions are identical may prove to be subspecifically distinct. There does appear to be some seasonal differences in color. Micos tend to be paler during the dry season than in the rainy season. Generally, however, the paler color is associated with old pelage and the darker, or warmer, color with new pelage. It cannot be determined now what part, if any, of these differences in color may be related to external factors and what part to the simple coincidence of the cycle of pelage change with seasonal changes. In any attempt to determine geographic gradients, it must be borne in mind that members of the genus *Cebus* are among the most mobile of American simians. Their wanderings and migrations cover more territory and diversities of ecological situations than is commonly supposed.

*Sexual dimorphism.*—There are obvious cranial differences between sexes. The skull of the adult male is larger and more heavily built throughout. Temporal crests, weakly developed in the species, are slightly better defined in males than in females; the frontal region of adult females shows the same slight vaulting noted in subadult males; orbital rings of females never attain the thickness of those of males; canines and lower first premolars of males much more developed. In males the upper canine projects more than 12 mm.

from alveolar rim or more than two and one-half times the corresponding length of the first premolar; in females the upper canine projects 10 mm. or less and is less than twice the corresponding length of the adjacent premolar.

Externally, partial dimorphism distinguishes many individuals of one sex from the other. A majority of females depart from the normal condition of a broad, pale superciliary band consisting of short, smoothly adpressed hairs. In these females a few to all hairs of forehead are comparatively long and erected in the form of a superciliary tuft or frontal diadem (fig. 52, *b*). Color of these hairs may be whitish to brown like cap. A dark forehead without tufts is noted in a few females. No exception to the condition of forehead described as normal has been noted among males. Generally, color of upper surface of tail is a continuation of that of median dorsal area where individual hairs are not banded terminally and subterminally with markedly contrasting colors. In a large percentage of males, terminal portions of hairs of upper surface of tail are buffy or pale yellowish and contrast sharply with the dark brown or reddish subterminal bands. This effects a "hoar-frosted" appearance on surface of tail. Tails of females do not exhibit definite hoar-frosting.

In the following tabulation the number of individuals with each of the various aspects of forehead and tail are summarized. Only specimens captured in the field are listed.

Males, normal.....	33
Males, with hoar-frosted tails.....	22
Females, normal, with broad, pale superciliary band.....	17
Females, with white frontal tufts.....	9
Females, with brown frontal tufts.....	14
Females, with brown untufted foreheads.....	2

No sharp line divides the four categories of females. The number given for normal females includes all those with foreheads as in males plus a number with incipient tufts and pale tones of brown. There is a gradual transition from white to brown tufted females. Pelage of forehead of the two brown untufted females is long and lax and may be erectile. Similarly, normal males grade into those with hoar-frosted tails. Males with questionably hoar-frosted tails have been listed as normal.

Superciliary tufts or frontal diadems appear also in many females of *C. capucinus* and *C. nigrivittatus*. Tufts of "untufted" species of *Cebus* consist of erect hairs of the superciliary region usually restricted to the forehead but sometimes extending for a very short distance over part of crown. In the latter case, a distinctly darker cap is usually absent. In true "tufted" species (*C. apella*) tufts are normally erect hairs of the coronal cap, not of the superciliary band.

*Dental anomalies.*—In material examined, two males and one female

lack both upper third molars. Two males and one female lack only the left upper third molar. One male (U. S. N. M. No. 281602) has an additional upper premolar in each jaw. This tooth lies between what are apparently quite normal first and second premolars. The supernumerary is in line with the longitudinal axis of the other molariform teeth but its crown is little more than half the width of the second premolar and shows considerably more wear. It occludes with the first and second lower premolars thus functionally replacing the first upper premolar which is unworn.

**CEBUS ALBIFRONS HYPOLEUCUS Humboldt**

(Cf. p. 338 for nomenclatorial discussion)

*Sai à gorge blanche* BUFFON, Histoire naturelle, générale et particulière avec la description du cabinet du Roi, Paris, vol. 15, p. 64, pl. 9, 1767.

*Simia hypoleuca* HUMBOLDT (*nec auctorum*), Recueil d'observations de zoologie et d'anatomie comparée, vol. 1, pp. 337, 356, 1812.

*Holotype*.—None preserved. Name and description based on individuals observed within their natural geographic range.

*Type locality*.—"Habite les rives du Rio Sinu et probablement aussi la Guyane française" (*op. cit.*, p. 356). Now restricted to the region about the mouth of the Río Sinú, Bolívar Department, Colombia.

*Distribution*.—Quoting Humboldt (*op. cit.*, p. 336), "Nous avons vu pour la première fois ce singe à l'embouchure du Rio Sinú, dans une cabane, près du Zapote [Bahía de Zispatá, east of the mouth of the Sinú]. Les mulâtres et les Zambos, qui se sont établis dans cet endroit sauvage, nous ont assuré que le Cariblanco étoit commun dans les belles forêts de palmiers qui s'étendent depuis le Sinú jusqu'au golfe de Darien. Nous en avons aussi rencontré plusieurs individus à Turbaco [near Cartagena], dans les maisons des Indiens."

*Characters*.—"Ex fusco nigra, facie, collo, pectore, humeris et brachiis (*haud antibrachiis*) ex albo flavescentibus.

"Cauda fusco-rubra, prehensilis, longitudine corporis. Facies nuda, albida. Ungues plani. Digiti subnudi. Aures ex albo flavicantes.

"Le Cariblanco du Rio Sinu a 0.35 m. (13 pouces) de long, depuis le front jusqu'à l'origine de la queue: c'est un singe très-doux et très-agile. Il a le port du Matchi vulgaire [*Cebus nigrivittatus*] ou Sajou [*Cebus apella*]: il pousse sans cesse un cri plaintif, en sifflant et en ridant le front. Son pelage est d'un brun noirâtre; mais la face, dégarnie de poils, les oreilles, le col, les épaules, la poitrine et l'avant-bras sont d'un blanc sale tirant sur le jaune. La queue prenante, qui a la longueur du corps, est d'un brun rougeâtre. Les Indiens m'ont assuré que le *Simia hypoleuca* parcourt les forêts par bandes très-nombreuses, et que ces bandes se tiennent séparées de celles des Matchis vulgaires. Cette circonstance me confirme dans l'opinion que ce singe n'est pas une variété du *Simia apella* ou du *S. capucina* des auteurs. Il diffère de ces dernières espèces par la couleur de la face, des épaules et de





Front view of skulls of adult male *Cebus* (natural size): a, *Cebus albifrons*, from northern Colombia; b, *C. apella*, from Paraná, Brazil.





Ventral aspects of skulls of adult male *Cebus* (natural size): a, *Cebus albifrons*, from northern Colombia; b, *C. apella*, from Paraná, Brazil.

la poitrine, qui ne sont pas d'un fauve pâle, mais d'un blanc très-clair, quoique un peu jaunâtre; et par le sommet de la tête, qui n'offre ni une calotte plus noire que le pelage du dos, ni une strie qui descend longitudinalement vers le front."

*Remarks.*—According to Humboldt, characters separating *hypoleucus* from other species of *Cebus* are "[transl.] the color of the face, shoulders and chest which are not pale tawny [as in the others] but of a very pure white, though a little yellowish; the cap of the crown which is not darker than the pelage of the back, and the absence of a stripe descending longitudinally on the forehead." Thus if it were not definitely expressed, it would be implicit that in other respects *hypoleucus* is brownish like the others. Mention of absence of a frontal stripe was intended to further distinguish *hypoleucus* from *albifrons*. This last, however, is a variable character and of no diagnostic value. The probability cited by Humboldt that *hypoleucus* may occur also in French Guiana excludes *Cebus capucinus* from consideration. It appears, then, that *hypoleucus* is a dark brown form of *albifrons*, with little if any contrast between color of back and forearms and forelegs, and most nearly resembles *malitiosus*.

The type locality of *hypoleucus* lies between the ranges of *malitiosus* and *pleei* (*nomen novum*, Río Magdalena) and of *Cebus capucinus* (Río Atrato and Panamá). It is highly probable, therefore, that both brown and black white-fronted cebids occur in the region of the Río Sinú. The Indians who reported to Humboldt that *hypoleucus* maintained itself apart from another species of monkeys may have been referring to true *Cebus capucinus*. Humboldt thought it was the "*Matchi vulgaire*," or *Cebus nigrivittatus*. This species, however, does not range west of the Andes.

The local name *cariblanco* adopted by Humboldt for *Cebus hypoleucus* is indiscriminately applied by Colombians to both *C. capucinus* and *C. albifrons*. The French collector Plée labeled his Colombian specimens of *C. albifrons* "*carita blanca*." The more generally used native name for "untufted" cebids is *mico*. Humboldt is followed in listing Buffon's *saï à gorge blanche* in the synonymy of *hypoleucus*.

*Specimens examined.*—None.

#### CEBUS ALBIFRONS MALITIOSUS Elliot

*Cebus capucinus*, ALLEN (*nec* Linnaeus), Bull. Amer. Mus. Nat. Hist., vol. 20, p. 467, 1904 (Santa Marta district: Bonda, Minca, Cacagualito).

*Cebus malitiosus* ELLIOT, Bull. Amer. Mus. Nat. Hist., vol. 26, p. 230, 1909; A review of the Primates, vol. 2, p. 98, 1913.

[*Cebus*] [*capucinus*] *cuscinus*, PUSCH, Zeitschr. für Säuget., vol. 16, p. 196, 1941 (part; *malitiosus* a synonym).

*Holotype.*—Adult male, skin and skull, A.M.N.H. No. 14620; collected by Herbert H. Smith.

*Type locality*.—Bonda, northwest corner of base of Sierra Nevada de Santa Marta, Magdalena, Colombia.

*Distribution*.—Known only from the northwestern base and foothills of the Sierra Nevada de Santa Marta, but probably ranges throughout the lower levels of the western and northern slopes of the Sierra Nevada.

*Characters*.—Pale area of front less extensive, upperparts and limbs paler than in *hypoleucus*. Cap Prout's Brown, median dorsal region Cinnamon Brown, forearm and foreleg not markedly contrasting in color with back and sides of body; hairs of belly and chest Ochraceous-Tawny to Cinnamon-Brown and silvery; contrasting pale area of front extending well over upper surface of shoulder and inner side of upper arm.

*Measurements*.—Of a male and female topotype, respectively: Greatest length of skull, 95.0, 92.7; condylobasal length, 72.3, 71.7; zygomatic breadth, 62.3, 61.9; width of brain case, 54.2, 51.6; length of brain case, 77.4, 72.1; orbital breadth, 53.2, 53.3; greatest width across maxillary tooth rows, 30.4, 30.9; length, upper canine to M<sup>3</sup>, 27.8, 26.9; length, lower canine to M<sub>3</sub>, 31.1, 29.0; mandibular depth at condyle, 27.8, 28.1 mm.

*Remarks*.—Of available material, this race most nearly approaches the characters ascribed to *hypoleucus*. Inclusion of the upper surface of shoulders in the whitish frontal area is more marked in *malitiosus* than in any other race, with the possible exception of *hypoleucus*.

Pusch synonymized *malitiosus* with the Peruvian *cuscinus* on the basis of a female from Santa Marta with a brown frontal tuft.

*Specimens examined*.—Eight. Bonda, 6 (C.N.H.M., 3; C.M., 3); Trojas de Cataca, Santa Marta, 2 (C.M.).

**CEBUS ALBIFRONS CESARAE, new subspecies**

*Holotype*.—Old adult male, U.S.N.M. No. 281588; collected August 24, 1942, by Philip Hershkovitz, original number 525.

*Type locality*.—Río Guaimaral, a channel of the Río Cesar, Magdalena Department, Colombia; altitude 140 meters.

*Distribution*.—Río Cesar Valley west into the southern and eastern slopes of the Sierra Nevada de Santa Marta to approximately 500 meters above sea level, eastern Magdalena Department, Colombia.

*Characters*.—Palest of the Colombian-Venezuelan races. Cap Cinnamon or Snuff Brown; median dorsal region, forearm and foreleg with orangeous and contrasted with sides of back and trunk; hairs of belly and chest Ochraceous-Orange to pale Ochraceous-Buff and silvery; contrasting pale area of front extending over variable amounts of upper surface of shoulder and inner side of upper arm.

*Coloration of holotype*.—Hairs of sides of face, superciliary band, chin, throat, sides of neck, and auricular region, Cartridge Buff. Cap

Snuff Brown; median dorsal band Sayal Brown with a slight ochraceous mixture, sides of back uniformly Sayal Brown, lateral fringe paler, basal portions of hairs Hair Brown mid-dorsally, becoming paler, to silvery, laterally; chest and belly mixed Ochraceous-Buff and Warm Buff, the hairs paler basally; front of shoulder Warm Buff, hairs on front of upper arm broadly Ochraceous-Orange subterminally, buffy basally and terminally, outer surface Cinnamon and silvery becoming darker, to Sayal Brown, on posterior border; hairs of lateral surface of forearm Pinkish Cinnamon subterminally with silvery apices creating a hoar-frosted effect, fore and hind surfaces more uniformly ochraceous; upper surface of hand mixed Cinnamon and Light Buff, fingers with light buffy hairs. Hairs of lateral surface of thighs Pinkish Buff subterminally, silvery apically, more uniformly orangeous in front, the hairs behind Cinnamon apically, silvery basally. Upper surface of tail hoar-frosted Cinnamon Brown, underside Pinkish Cinnamon proximally, gradually becoming Ochraceous-Buff to yellowish terminally.

*Coloration of the paratypes* (16 males and 11 females from Guaimaral, 10 males and 3 females from El Orinoco, 5 km. east of the Río Cesar).—**DARK PHASE:** Cap Snuff Brown to Bister, or Cinnamon-Brown to Prout's Brown; median dorsal line usually a tone paler than cap, ranging from Prout's Brown to Ochraceous-Tawny, or Bister to Sayal Brown; sides of back and lateral fringe paler, Snuff Brown or Cinnamon-Brown, the color extending over lower half of outer side of upper arm to elbow; upper half of upper arm in front grading from whitish or yellowish of shoulder through Ochraceous-Orange or Tawny into the Cinnamon-Brown of forearm; hairs of forearm often silvery to buffy apically; hand above like forearm or darker, frequently mixed or edged with whitish hairs. Belly sparsely covered with silvery to Ochraceous-Orange hairs. Inner surface of thigh like belly, front and lateral surfaces like side of back and grading into Ochraceous-Orange to Tawny of foreleg. Other parts as described for the species. **PALE PHASE:** Cap Avellaneous to Buffy Brown, or Cinnamon to Sayal Brown. Median dorsal line Ochraceous-Buff to Ochraceous-Tawny, or Cinnamon-Buff to Sayal Brown; side of back paler, Light Ochraceous-Buff or Cinnamon-Buff to Cinnamon, lateral fringe like side of back or with a wash of orangeous; belly silvery to Ochraceous-Buff. The above colors are distributed over remaining parts in same manner as in dark phase individuals.

Division between dark and light color phases is made arbitrarily to facilitate description of the race. Variation in color ranges gradually from one extreme to the other. In general, young adults are paler than older ones. A female and nine males taken between April 2 and 5, during the long dry season, are in old pelage and markedly paler

than others taken from August 20 to October 27, during the short dry season or *veranillo* (Aug.-Sept.) and the heavy rainy season.

One immature, possibly 6 to 10 weeks old, with all milk incisors fully erupted, taken August 30, is Ochraceous-Orange middorsally, side of body Ochraceous-Buff, fore and hind limbs on outer sides mixed Ochraceous-Orange and Ochraceous-Buff; poorly defined cap Drab; proximal half of tail both above and below, Ochraceous-Orange, terminally paler grading into Warm Buff at tip; underparts, including chin and throat, practically bare.

An immature, possibly 12 to 14 weeks old, with canines half cut, first premolars emerging, taken August 23, is darker than preceding and nearly like adults of "pale phase"; development of pelage of underparts about one-half that of adults.

*Measurements.*—Those of the holotype are followed by the means and extremes of 18 adult males, including holotype of the type series, and by the means and extremes of 10 adult females of the type series: Head and body, 380, 384 (348–407); 368 (353–385); tail, 459, 454 (419–495); 478 (461–500); hind foot, 126, 127 (119–136); 125 (114–145); ear, 40, 37 (35–40); 36 (34–37); greatest length of skull, 97.4, 92.8 (89.2–97.4); 88.6 (86.4–91.2); condylobasal length, 72.0, 70.1 (66.0–73.3); 65.9 (63.7–67.4); zygomatic breadth, 65.7, 61.8 (58.3–67.1); 56.7 (53.4–58.4); width of brain case, 50.5, 50.8 (49.2–53.6); 49.3 (48.0–51.0); length of brain case, 78.6, 74.9 (70.9–78.6); 71.5 (70.2–73.6); orbital breadth, 55.2, 51.8 (47.5–55.6); 48.3 (46.4–51.7); greatest width across maxillary tooth rows, 29.1, 28.1 (26.3–29.6); 26.9 (25.9–27.8); length, upper canine to  $M^3$ , 27.2, 26.3 (24.6–28.3); 25.2 (24.7–25.7); length, lower canine to  $M_3$ , 29.8, 29.0 (27.3–30.4); 27.3 (26.1–28.2) mandibular depth at condyle, 30.8, 27.3 (23.3–30.8); 24.9 (23.3–26.6 mm.).

*Villanueva* (1 adult, 2 immature males, 1 adult female): *Adult male*: Cap Snuff Brown, median dorsal band mixed Tawny and Orange-Cinnamon, side of back and lateral fringe Cinnamon; forearm and hind leg nearly uniformly Tawny; hairs of upper proximal portion of tail Tawny tipped with buffy, terminally Cinnamon-Brown more broadly tipped with Warm Buff, gradually becoming paler toward tip, under-surface Tawny proximally, becoming buffy terminally. *Adult female*: Paler throughout than the male, without the hoar-frosted appearance of tail. *Immatures*: Both extremely pallid, the paler of the two with cap Warm Buff, median dorsal band Ochraceous-Buff, sides of body and upper arm Cream Buff, forearm from Ochraceous-Buff to Ochraceous-Tawny at wrist; thigh Ochraceous-Buff to Ochraceous-Orange, foreleg Ochraceous-Tawny; tail above Ochraceous-Buff proximally, becoming Warm Buff terminally, underside Warm Buff proximally to nearly pure white terminally; other immature more cinnamon, tail above, and forearm hoar-frosted.



One specimen was taken January 22, the others on February 23, during the dry season. They are in old pelage, extremely pale, and agree with the pale series taken later (April 2 to 5) in the Cesar-Guaimaral region toward the end of the same dry season.

Deforestation in the upper Río Cesar Valley has reached a point where these monkeys may be completely isolated now from their relatives lower down the valley and in the mountain forests. Because of deforestation, the region is becoming arid and some mammals here tend to average paler than those of the Cesar-Guaimaral region. Nevertheless, the micos have differentiated hardly at all. A comparison of these monkeys with those taken only during the rainy season in the Cesar-Guaimaral region would lead, however, to very different conclusions regarding the extent of differentiation.

*Measurements.*—One adult male and one adult female, respectively: Head and body, 356, 341; tail, 450, 415; hind foot, 121, 117; ear, 37, 35; greatest length of skull, 92.7, 85.0; condylobasal length, 71.6, 61.6; zygomatic breadth, 63.9, 54.8; width of brain case, 48.0, 48.6; length of brain case, 75.4, 68.4; orbital breadth, 56.1, 49.9; greatest width across maxillary tooth rows, 27.6, 26.9; length, upper canine to  $M^3$ , 26.0, 24.1; length, lower canine to  $M_3$ , 28.2, 27.1; mandibular depth at condyle, 27.8, 24.1 mm.

*El Salado* (3 males, 4 females): Tawnier on dorsum and limbs than the Río Cesar series. Four specimens taken July 17, in prime pelage, tawnier than the warmest-colored individual of the "dark phase" group of the Cesar. Remaining three specimens, one taken June 10, others June 15, in old pelage, paler but still average warmer on dorsum and limbs than average "dark phase" individuals of the Cesar.

The specimens were taken on the eastern slope, near the base, of the Sierra Nevada de Santa Marta, altitude about 300 meters. Their slight though consistent difference in color from the typical series may be seasonal as well as a peculiarity of the population they represent. They approach *malitiosus* in color but geographically are nearest *cesarae*. There are no barriers between the micos of the Cesar and those of the southern and eastern slopes of the Sierra Nevada. Large portions of the originally unbroken forest are still extant between the two zones.

*Measurements.*—Those of two adult males followed by those of two adult females: Head and body, 423, 398; 382, 364; tail, 436, 401; 458, 461; hind foot, 122, 125; 123, 128; ear 38, 40; 40, 40; greatest length of skull, 93.9, 91.2; 91.0, 89.9; condylobasal length, 69.2, 69.1; 68.7, 66.1; zygomatic breadth, 62.9, 62.9; 59.8, 56.6; width of brain case, 50.5, 50.4; 51.7, 48.7; length of brain case, 76.1, 72.7; 75.2, 71.4; orbital breadth, 50.1, 49.8; 52.5, 48.1; greatest width across maxillary tooth rows, 29.4, 27.7; 27.6, 26.5; length, upper canine to  $M^3$ , 27.3,

—; 24.6, 25.4; length, lower canine to  $M_3$ , 30.5, 29.2; 27.2, 26.7; mandibular depth at condyle, 27.3, 26.7; 27.9, 27.4 mm.

*Colonia Agrícola de Caracolicito* (4 males, 3 females): Median dorsal region, forearm and foreleg Ochraceous-Tawny to Cinnamon-Brown mixed with Tawny; belly silvery to Ochraceous-Orange. Paler specimens agree with dry season "pale phase" individuals of topotypical *cesarae*, the darker specimens grade into *malitiosus*. All individuals retain to a greater or lesser degree the orangeous tinge of forearm and foreleg characteristic of *cesarae*. Hairs of upper surface of tail in one female with apical banding resembling in an ill defined manner the hoar-frosted appearance of tail in males.

*Measurements*.—Those of two adult males followed by those of two adult females: Head and body, 405, 436; 418, 403; tail 468, 441; 463, 450; hind foot, 123, 123; 119, 124; ear, 37, 42; 37, 40; greatest length of skull, 94.6, 96.4; 91.6, 93.3; condylobasal length, 71.7, 75.3; 67.6, 68.9; zygomatic breadth, 63.2, 65.3; 59.5, 59.5; width of brain case, 51.2, 53.5; 50.3, 50.9; length of brain case, 76.9, 75.9; 73.0, 73.6; orbital breadth, 53.0, 53.4; 51.0, 52.2; greatest width across maxillary tooth rows, 28.8, 30.7; 28.4, 28.2; length; upper canine to  $M^3$ , 26.9, 26.8; 25.3, 24.6; length, lower canine to  $M_3$ , 30.0, 30.6; 27.2, 27.7; mandibular depth at condyle, 27.4, 30.1; 26.1, 25.6 mm.

*Remarks*.—Micos of the Cesar Valley proper differ notably from all others. The specimens taken there represent individuals of various clans and, with the exception of the Villanueva monkeys, interbreeding between these groups could easily be effected. On the other hand, each of the series from the eastern and southern slopes of the Sierra Nevada de Santa Marta are members of clans which now may have little if any association with those of the Cesar. Their characters show gradation into *malitiosus* of the western slope of the Sierra Nevada.

*Specimens examined*.—Sixty. El Orinoco and Río Guaimaral, Río Cesar, 42 (U.S.N.M.); Villanueva, 4 (U.S.N.M.); El Salado 7 (U.S.N.M.); Colonia Agrícola de Caracolicito, 7 (U.S.N.M.).

**CEBUS ALBIFRONS PLEEI, new subspecies**

*Cebus chrysopus*, *auctorum* (*nec* Lesson and *sajou à pieds dorés* Cuvier).

*Cebus albifrons*, ELLIOT, A review of the Primates, vol. 2, p. 88, 1913 (part; Colombia).

*Holotype*.—Adult male, skin and skull, U.S.N.M. No. 281624; collected May 29, 1943, by Philip Hershkovitz; original number 2029.

*Type locality*.—Swamplands of western bank of Río Magdalena near village of Norosí at base of northern extremity of Cordillera Central, Mompós, department of Bolívar, Colombia; altitude approximately 50 meters.



*Distribution*.—Between the Ríos Cauca and Magdalena, department of Bolívar, Colombia.

*Characters*.—Warmest colored of the races. Cap Prout's Brown; median dorsal region, forearm, and foreleg with reddish contrasting with brownish of sides of body; hairs of chest and belly Mars Orange to Hazel and silvery; contrasting pale area of front reduced or obsolete on shoulder.

*Coloration of holotype*.—Sides of face and neck, auricular region and chin, Cartridge Buff; Cap Prout's Brown; median dorsal band Sanford's Brown behind nape and on rump, less orangeous in middle portion; side of back Cinnamon-Rufous, lateral fringe Cinnamon-Brown lightly washed with orangeous. Chest and belly Orange-Rufous to Mars Orange, the hairs silvery basally; throat, front of shoulder buffy becoming orangeous distally to grade into Mars Orange of front of upper arm; outer side of upper arm Cinnamon-Brown grading into Burnt Sienna of forearm; dorsal surface of hand darker, fingers with reddish hairs. Thighs Sanford's Brown in front and behind, rufous laterally; foreleg uniformly Burnt Sienna, upper surface of foot and hairs of toes, Auburn. Upper surface of tail Burnt Sienna proximally, becoming Hazel distally, the hairs tipped with Cinnamon- Buff, tail terminally nearly uniformly Cinnamon- Buff; under surface of tail Cinnamon-Rufous proximally, becoming Cinnamon- Buff terminally.

*Coloration of paratopotypes* (2 adult males, 1 subadult male, 1 female).—Males like holotype but with greater amount of Cinnamon-Brown on forearm and foreleg. One male with Cinnamon-Brown of upper arm extending distally over lateral surface of lower arm; front and rear surfaces of forearm Burnt Sienna; upper surface of hand and hairs of fingers Auburn. Other adult male intermediate in distribution of orange and brown on fore and hind limbs, with hand and foot darker, belly more brown. Tails of both males darker than in holotype. Female, an immature with first four molariform teeth deciduous, Burnt Sienna on lower back, forearm and foreleg, becoming darker, to Auburn, on wrist, ankle, upper surface of hand and foot; hairs of belly Ochraceous-Tawny; foreback, cap, and tail paler than in the males.

The female and one male were taken May 29, the other male on June 24. These dates are in the rainy season, which was unusually heavy in 1943. Pelage of all specimens, including holotype, appears to be new.

*Río San Pedro, above Norosí* (1 adult male): An extremely dark reddish brown individual in prime pelage that may represent a dark phase. Cap blackish brown; median dorsal region between Burnt Sienna and Chestnut, side of back Auburn; side, lateral fringe and outer side of upper arm Prout's Brown; hairs of chest and belly Orange-Rufous to

Mars Orange; shoulder patch obsolete; front side of arm Burnt Sienna, lateral and rear surfaces of forearm Chestnut, upper surface of hand darker. Lateral surface of thigh Prout's Brown grading into Burnt Sienna of rear; foreleg Burnt Sienna becoming Chestnut on ankle and top of foot. Upper proximal surface of tail Prout's Brown, the hairs tipped with Orange-Rufous, underside Mars Orange, the whole becoming paler distally for nearly two-thirds of length where tail is bobbed.

The above specimen was taken in the Cordillera Central southwest of Norosí, altitude about 125 meters. At the time of collecting in this locality (June 1943) during a very rainy period, monkeys were scarce. However, they were said to be numerous during the dry season. At the same time, *pleei* was abundant in the flooded lowlands between Norosí and the Río Magdalena.

*Measurements.*—Those of the holotype are followed by those of an adult male paratype, and an adult male from Río San Pedro: Head and body, 397, 392, 422; tail, 495, 478, —; hind foot, 135, 134, 126; ear, 38, 34, 35; greatest length of skull, 95.0, 91.7, 94.1; condylobasal length, 73.6, 71.7, 74.8; zygomatic breadth, 60.6, 60.5, 63.5; width of brain case, 47.7, 48.2, 49.3; length of brain case, 74.3, 74.1, 76.3; orbital breadth, 49.4, 49.4, 54.0; greatest width across maxillary tooth row, 28.7, 27.0, 27.9; length, upper canine to  $M^3$ , 26.8, 24.2, 25.9; length, lower canine to  $M_3$ , 30.3, 27.6, 29.6; mandibular depth at condyle, 28.9, 25.3, 29.4 mm.

*Remarks.*—The geographically nearest race is *hypoleucus* of the Río Sinú region. Where the ranges of *hypoleucus* and *pleei* meet cannot be ascertained. Differences between the two forms are great, and it must be assumed that the Río Cauca (and the San Jorge) acts as a very nearly complete barrier to intergradation between them. Differences between *pleei* and the considerably paler *cesarae* are of a comparable magnitude. Here separation between the two forms is effected by the Río Magdalena.

Unavailability of the name *chrysopus* for micos of the lower Cauca-Magdalena Valley has already been discussed (p. 342). The pale "*Chrysope*" originally figured and described by Cuvier bears no close resemblance to the extremely warmly colored *pleei*.

As noted elsewhere (p. 342), the first specimens of *pleei*, erroneously identified as *chrysopus* by authors, were collected by Plée. One of his micos in the Muséum d'Histoire Naturelle des Pays-Bas, acquired from the Paris Museum, was recorded by Schlegel (1876, p. 196) as *Cebus albifrons*. The label of the specimen bore the name "carita blanca." Very little is known of the collector for whom the present monkey is named. He was one of three young students selected by the faculty of the Muséum National d'Histoire Naturelle, Paris, and

sent abroad in 1820 for the purpose of exploring the natural history of little-known regions. The first of the student travelers, Godefroy, was killed in an insurrection by natives shortly after his arrival at Manila. The second, Havet, died in Madagascar following hardships he endured in pursuing his work. The third, Plée, arrived safely at the island of St. Thomas in the Antilles. He then proceeded to Martinique and was supposed to have continued into Colombia, Venezuela, and the United States. The time spent by Plée in his travels is not exactly known. He made three shipments of his collections to the Paris Museum, but the specimens sent were accompanied by little or no data. The last shipment was made from the Antilles in 1826, after Plée's death. Presumably, Plée kept a personal account of his itinerary, his observations, and the specimens he preserved. Unfortunately, he, like the others, met with an untimely death in the midst of his work, and all the valuable information he might have accumulated was lost with him. There has been little confusion, however, in determining the Colombian locality of certain mammals collected by Plée. Comparison of Plée specimens with Colombian mammals have fairly well established that they must have originated at various points along the banks of the Río Magdalena in the departments of Magdalena and Bolívar.

*Specimens examined*.—Five. Norosí, 4 (U.S.N.M.); Río San Pedro, 1 (U.S.N.M.).

**CEBUS ALBIFRONS VERSICOLOR Pucheran**

(Cf. p. 343 for nomenclatorial discussion)

*Cebus versicolor* PUCHERAN, Rev. Zool., Paris, vol. 8, p. 335, 1845.—CABRERA, Rev. Real. Acad. Cienc. Madrid, vol. 16, ser. 2, p. 230, 1917.

*Cebus albifrons*, SCHLEGEL, Mus. Hist. Nat. Pays-Bas, p. 195, 1876 (part; specimen No. 3, p. 197, "près de Medellin").—ELLIOT, A review of the Primates, vol. 2, p. 88, 1913, (part).

*Cebus [apucinus] versicolor*, PUSCH, Zeitschr. für Säuget., vol. 16, p. 193, 1941, part (Colombia).

*Holotype*.—Mounted specimen, skull in skin, Muséum National d'Histoire Naturelle, Paris, Type Catalogue No. 86, Accession Catalogue No. 559 (479); received from M. Jurgens in 1844.

*Type locality*.—Originally given as "Santa-Fe de Bogota," Colombia. No monkeys occur in the immediate vicinity of the city of Bogotá (see Remarks, below).

*Distribution*.—The middle Río Magdalena region exclusive of the western slope of the Cordillera Oriental, from the departments of Cundinamarca and Tolima north as far as the southern portion of the department of Magdalena (Gamarra), Colombia.

*Characters*.—Paler than *pleei*, less red on dorsal surface; darker than *cesarae*, more red on limbs. Cap Snuff Brown to Prout's Brown; median dorsal region Snuff Brown becoming Tawny posteriorly;

forearm and foreleg Orange-Rufous to Chestnut sharply contrasting with anterior half of back and side of body; hairs of belly and lower part of chest Orange-Rufous to Burnt Sienna and silvery, of upper part of chest, silvery and buffy; pale area of front extending slightly or not at all over upper surface of shoulder.

*Río Chili, Tolima, tributary of upper Cucuana, altitude between 500 and 700 meters* (1 male, 1 female): *Adult male*: Cap Prout's Brown, nape paler, upper median dorsal region Snuff Brown, posteriorly becoming Ochraceous-Tawny to Tawny on rump and basal portion of upper surface of tail; side of back Snuff Brown becoming Sayal Brown on side and lateral fringe; hairs of belly Orange-Rufous terminally, silvery basally, of chest silvery; front of shoulder whitish, the hairs tipped with pinkish. Outer side of upper arm Snuff Brown, forearm and front of upper arm Burnt Sienna; wrist Chestnut, upper surface of hand and hairs of fingers Bay. Thigh Sanford's Brown laterally, Burnt Sienna in front; foreleg Burnt Sienna becoming darker distally, to Chestnut on ankle and upper surface of foot, hairs of toes Bay. Tail grading to Warm Buff terminally both above and below. *Adult female*: Size small but with complete permanent dentition; extremely pale due to worn condition of pelage, the pale basal portions of hairs exposed and dominating in superficial coloration of back. Cap Snuff Brown; upper median dorsal region, sides of back and lateral fringe Wood Brown, lower half of median dorsal region and base of tail above, Ochraceous-Tawny; whitish patch extending from front to upper surface of shoulder; outer side of forearm Sanford's Brown, of foreleg Orange-Rufous. Tail, except at base, Ochraceous-Buff below, browner above.

*Gamarra, Río Magdalena, altitude 69 meters* (1 male, 3 females): Cap Cinnamon-Brown to Prout's Brown; median dorsal region anteriorly Snuff Brown to Sayal Brown with a light wash of Tawny, posteriorly more Tawny; side of back paler, with less Tawny, becoming Sayal Brown on sides of body and lateral fringe; hairs of belly Orange-Rufous to Burnt Sienna, becoming buffy to whitish on chest. Brown of side extending over upper surface of shoulder and outer side of upper arm; forearm and front of upper arm Sanford's Brown to Burnt Sienna; upper surface of hand, in one female Ochraceous-Buff with an orangeous patch, hairs of fingers Ochraceous-Buff, in remaining specimens, hands and fingers more orange. Thigh Orange-Rufous to Sanford's Brown on lateral surface, upper surface of foot darker, fringed with buffy hairs; toes with a mixture of buffy and Bay hairs. Tail in females Snuff Brown above, Cinnamon beneath becoming buffy terminally, in male the hairs Prout's Brown with light tips above, beneath Tawny proximally, the whole becoming paler distally.

The series differs from both *pleei* and the type and Tolima specimens

of *versicolor* by paler hands and wrists. Identity with typical *versicolor* is shown, however, by coloration of ventral surface, sharp contrast between median dorsal region and reddish limbs, and by the pale tail.

*Measurements*.—The cranial measurements of an adult male and female from Río Chili are followed by those of two young adult females from Gamarra: Greatest length of skull, 96.8, 85.5; 88.3, 85.8; condylo-basal length, 71.6, 64.0; 66.9, 61.7; zygomatic breadth, 64.4, 53.6; 57.4, 54.8; width of brain case, 53.1, 46.3; 48.8, 47.8; length of brain case, 74.5, 70.0; 70.3, 70.3; orbital breadth, 51.1, 46.6; 49.4, 45.7; greatest width across maxillary tooth rows, 30.0, 26.1; 28.9, 26.4; length, upper canine to M<sup>3</sup>, 28.1, 24.2; 25.8, 24.6; length, lower canine to M<sub>3</sub>, 30.5, 26.3; 27.9, 26.9; mandibular depth at condyle, 25.0, 25.5; 25.4, 22.7 mm.

*Remarks*.—Santa Fé de Bogotá, where *versicolor* was said to have originated, is also the ancient name of a large area comprising the present department of Cundinamarca and parts of neighboring departments, including the upper Río Meta region. The above described male from Río Chilí, Tolima, agrees best with the type. Nevertheless, it would be premature to regard it as certainly typical. The nature of material here assigned to *versicolor* indicates, nevertheless, that the type specimen did originate somewhere in the middle Río Magdalena Valley exclusive of the western slope of the Cordillera Oriental north of Bogotá.

Nape and upper surface of hands and feet of type are dark brown, not black as originally described.

*Specimens examined*.—Seven. Holotype (M.N.H.N.); Río Chilí, 2 (U.S.N.M.); Gamarra, 4 (C.M.).

**CEBUS ALBIFRONS LEUCOCEPHALUS** Gray

(Cf. p. 344 for nomenclatorial discussion)

*Cebus leucocephalus* GRAY, Proc. Zool. Soc. London, 1865, p. 827, fig. 4, 1865.—CABRERA, Rev. Real. Acad. Cienc., Madrid, vol. 16, ser. 2, p. 230, 1917 (synonym of *versicolor*).

*Cebus hypoleucus*, MARTÍNEZ, Soc. Esp. Hist. Nat. Madrid, vol. 2, p. 242, 1873 ("Bogotá").

*Cebus apella leucocephalus*, OSGOOD, Publ. Field Mus. Nat. Hist., zool. ser., vol. 10, p. 32, 1910 (Orope, Venezuela).

*Cebus albifrons*, ELLIOT, A review of the Primates, vol. 2, pp. 88, 89, 1913 (part; *leucocephalus*, synonym).

[*Cebus*] *c[apucinus] versicolor*, PUSCH (not Pucheran), Zeitschr. für Säuget., vol. 16, p. 193, 1941.

*Holotype*.—In British Museum (Natural History); purchased from Parzudaki.

*Type locality*.—"Colombia." Here restricted to El Tambor, Río Lebrija, 25 km. northwest of Bucaramanga, Santander, Colombia.

*Distribution*.—Western slope of Cordillera Oriental, department of Santander, east through low passes to the Río Zulia-Río Catatumbo drainage basin, department of Norte de Santander, Colombia, and state of Zulia, Venezuela.

*Character*.—Darkest race of *albifrons*. Cap Cinnamon-Brown to Bister; median dorsal region Cinnamon-Brown mixed with Tawny, forearm and foreleg Sanford's Brown to Russet or Bay, moderately contrasted with back and sides; hairs of belly and chest from nearly uniformly buffy to nearly uniformly Mars Orange; pale area of front not extending over upper surface of shoulder, reduced or obsolete on front of shoulder.

*Coloration of adult male topotype*.—Cap Bister, nape Prout's Brown; median dorsal region Cinnamon-Brown with a slight Tawny tinge anteriorly, becoming Russet posteriorly, sides paler becoming Snuff Brown on lateral fringe. Buffy shoulder patch nearly obsolete in front; upper side of shoulder and lateral surface of upper arm Cinnamon-Brown; outer side of upper arm and inner side of forearm Sanford's Brown; outer side of forearm approximately Burnt Sienna, posterior side darker grading into Auburn of wrist and upper surface of hand; hairs of fingers mixed Auburn and buffy. Lateral surface of thigh Cinnamon-Brown, front of thigh and foreleg Burnt Sienna becoming Auburn on ankle and top of foot; hairs of toes blackish. Hairs of belly and lower part of chest Burnt Sienna becoming Orange-Rufous on upper part of chest and inner side of upper arm. Tail above Cinnamon-Brown proximally, becoming slightly paler terminally, underside Cinnamon-Brown but hairs with longer buffy basal portions than above, terminally the hairs becoming increasingly buffy.

An immature male topotype with milk premolars and uncut third molar is approximately a tone paler throughout than the adult male.

*Measurements*.—Of the adult male topotype: Head and body, 407; tail, 499; hind foot, 132; greatest length of skull, 99.1; condylobasal length, 76.7; zygomatic breadth, 63.1; width of brain case, 51.6; length of brain case, 78.0; orbital breadth, 51.0; greatest width across maxillary tooth rows, 29.5; length, upper canine to  $M^3$ , 28.3; length, lower canine to  $M_3$ , 30.9; mandibular depth at condyle, 30.5 mm.

*Bella Vista, Río Tarra, Norte de Santander*, altitude 500 meters (1 adult male): Cap Prout's Brown with a mixture of black-tipped hairs; streaks of long, brownish-tipped hairs on front and side of face; hairs of median dorsal region Cinnamon-Brown to Prout's Brown subterminally, Ochraceous-Tawny terminally, the whole appearing as a fine mixture of both colors, the darker dominating anteriorly, the paler posteriorly; side of body and lateral fringe Prout's Brown. Upper surface of shoulder and lateral surface of upper arm Sanford's Brown grading into nearly Auburn of forearm and upper surface of hand;



hairs of fingers blackish. Lateral surface of thigh like rump becoming uniformly Sanford's Brown on inner, fore and hind sides; foreleg Burnt Sienna, ankle and top of foot darker, hairs of toes blackish. Hairs of belly, chest and front of shoulder Mars Orange with silvery bases. Proximal portion of tail above like back, terminally assuming a hoar-frosted appearance; tail beneath Cinnamon-Brown proximally to Pinkish Cinnamon terminally.

The specimen is in new pelage, its coloration unusual. The fine ticking on the median dorsal region recalls the condition characteristic of *Cebus nigrivittatus*. In this species, however, the ticking is much coarser, the hairs longer and laxer, the annulations more sharply contrasted in color. The above described brown streaks on side of face extend from the brown eye brows across jowls. In *Cebus apella*, the characteristic dark line is immediately in front of ears and extends from crown to beneath chin.

*Measurements*.—Head and body, 370; tail, 392; hind foot, 119; ear, 36; greatest length of skull, 92.5; condylobasal length, 69.9; zygomatic breadth, 62.2; width of brain case, 47.7; length of brain case, 74.1; orbital breadth, 50.2; greatest width across maxillary tooth rows, 28.9; length, upper canine to  $M^3$ , 27.3; length, lower canine to  $M_3$ , 30.3; mandibular depth at condyle, 26.3 mm.

*Orope, Zulia* (2 males, 5 females, all young adults): Cap Prout's Brown to Bister; median dorsal region Cinnamon-Brown to Prout's Brown with or without a Tawny overlay; sides paler, lateral fringe Cinnamon-Brown to Snuff Brown; outer side of upper arm like side of back; front of upper arm and lateral surface of forearm Sanford's Brown to Auburn, wrist and upper surface of hand Bay; hairs of fingers mixed buffy and Bay to blackish. Outer side of thigh like rump, front more red; foreleg and foot like forearm and hand. Hairs of belly Burnt Sienna or Ochraceous-Orange, chest Burnt Sienna or Ochraceous-Buff to Ochraceous-Orange, the buff continuing onto front of shoulder. Upper surface of tail Bister to Prout's Brown proximally, terminally becoming only slightly paler, in one specimen, to buffy, in another; undersurface Tawny to buffy terminally. The skins are in a bad state of preservation; pelage old and worn with a faded appearance on sides of lateral fringe due to prominent exposure of the pale basal portions of the hairs. The specimens were taken March 2, 1908, during the dry season.

*Measurements*.—Those of a young adult male and female, the largest individuals of the series: Head and body, 395, 330; tail, 405, 440; hind foot, 115, 115; ear, 35, 30; greatest length of skull, 89.5, 86.9; condylobasal length, 67.6, 62.6; zygomatic breadth, 56.9, 57.2; width of brain case, 49.3, 48.9; length of brain case, 71.1, 71.4; orbital breadth, 49.1, 48.2; greatest width across maxillary tooth rows, 27.1,



25.8; length, upper canine to M<sup>3</sup>, 26.1, 25.1; length, lower canine to M<sub>3</sub>, 23.7, 24.4; mandibular depth at condyle, 27.1, 25.8 mm.

*Remarks.*—Distinction of *leucocephalus* from *versicolor* was originally premised on the presence of a midfrontal line in the former and its absence in the latter. The nature of this character, shown repeatedly to be individually variable, together with the Colombian habitat of both *leucocephalus* and *versicolor*, induced most authors to regard the two as identical. Each form, however, occupies a distinct geographical area, and *leucocephalus* is much the darker monkey.

The detailed description of the "Bogotá" monkey recorded as *hypoleucus* by Martínez (*op. cit.*) agrees with *leucocephalus*. The true habitat of this individual was probably somewhere in the Andean forests north of Bogotá and is, no doubt, the same specimen assigned to *leucocephalus* by Cabrera (*op. cit.*). The Orope, Venezuela, series includes specimen No. 16567 (C.N.H.M.) that Osgood (1910, p. 32) compared with the type of *leucocephalus*. The nearly complete agreement noted by Osgood between his specimen and the type, applies equally well to the individual described above from El Tambor, Colombia. Hence, restriction of type locality to this last place conforms both to the country originally stated to be the habitat as well as to that part of Osgood's suggestion that the "exact locality was at least in northeastern Colombia."

Fischer (1829, pp. 57, 545) listed *Pithecia leucocephala* Geoffroy as *Cebus leucocephalus*. The result of this action may be regarded by some as a "preoccupation" of *Cebus leucocephalus* Gray. Article 35 of the International Code, as here interpreted, relates primarily to names given to species and subspecies described as new and not to secondary combinations resulting from transfer of species and subspecies to genera other than those under which they were originally described. However, in the event that two identical specific names each originally assigned to a different genus are subsequently included in the same genus, the more recent specific name is rejected but not *suppressed*. Such "secondary homonyms" revert to their original status when generically removed from preoccupying specific names. Names substituted for such "secondary homonyms" then become absolute synonyms of them. The status of *Cebus nigrivittatus* Wagner (= *Cebus leporinus* Pusch, *cf. supra* p. 345) is a case in point. The name *Cebus leucocephalus* Gray cannot be construed as either a primary or a secondary homonym under any circumstance.

*Specimens examined.*—Eleven. Type of *leucocephalus* Gray (B.M.); El Tambor, Santander, Colombia, 2 (C.M.); Bella Vista, Río Tarra, Norte de Santander, Colombia, 1 (U.S.N.M.); Orope, Zulia, Venezuela, 7 (C.N.H.M.).

**CEBUS ALBIFRONS ADUSTUS, new subspecies**

[?] *Cebus apella leucocephalus*, OSGOOD, Publ. Field Mus. Nat. Hist., zool. ser., vol. 10, p. 66, 1912 (El Panorama, Río Aurare, Venezuela).—CABRERA, Rev. Real Acad. Cienc., Madrid, vol. 16, ser. 2, p. 230, 1917.

*Holotype*.—Adult male, skin and skull, C.N.H.M. No. 22194; collected February 22, 1920, by W. H. Osgood and H. B. Conover; original number 5141.

*Type locality*.—Near head of Río Cogollo (Apón) at eastern base of Sierra de Perijá, about 5 kilometers northwest of Machiques, Lake Maracaibo region, Zulia, Venezuela; altitude about 100 meters above sea level.

*Distribution*.—Known only from type locality; range probably extends across the northern half of the Sierra de Perijá in Venezuela and Colombia.

*Characters*.—Paler throughout than *leucocephalus*; limbs redder, more sharply contrasted with trunk than in *malitiosus*. Cap Cinnamon-Brown; median dorsal region Sayal Brown anteriorly, becoming Tawny posteriorly; forearm and foreleg Russet to Burnt Sienna strongly contrasted with back and Sayal Brown of sides; hairs of belly and lower part of chest Mars Orange to Burnt Sienna, of upper part of chest ochraceous with buffy bases; pale area of front extending to upper part of shoulder.

*Coloration of holotype*.—Cap Cinnamon-Brown, anterior portion of back Sayal Brown, posterior portion Tawny; sides, lateral fringe, and outer side of upper arm, Sayal Brown, forearm nearly uniformly Russet; hand above Russet edged with buffy, fingers with grayish hairs. Thigh and foreleg Burnt Sienna becoming nearly Chestnut on upper surface of foot, toes with mixed buffy and dark brown hairs. Hairs of belly and lower part of chest Mars Orange and Burnt Sienna, of upper part of chest and axillae, buffy with Ochraceous-Orange tips. Tail above hoar-frosted in appearance, the hairs Cinnamon-Brown tipped with buffy, beneath Mars Orange proximally becoming Ochraceous-Orange to buffy terminally.

One adult male paratopotype like holotype but slightly paler on back, chest, and tail; hind legs slightly redder.

*Measurements*.—Those of the holotype followed by those of a male and female topotype: Greatest length of skull, 94.7, 91.8, 87.9; condylobasal length, 70.5, 67.1, 63.3; zygomatic breadth, 67.0, 61.5, 57.0; width of brain case, 51.1, 50.3, 48.8; length of brain case, 75.0, 75.1, 71.7; orbital breadth, 52.9, 51.6, 46.3; greatest width across maxillary tooth rows, 28.6, 27.4, 26.6; length, upper canine to M<sup>3</sup>, 26.3, 26.4, 24.7; length, lower canine to M<sub>3</sub>, 29.5, 28.8, 27.3; mandibular depth at condyle, 30.4, 26.3, 24.0 mm.

*Remarks*.—*C. a. adustus* differs in a comparatively small degree from its nearest relative, *malitiosus* of the Sierra Nevada de Santa

Marta. Its fore and hind limbs are redder, especially on undersurface, cap paler and the pale frontal area considerably more restricted in extension. Intergrades may occur along the northern slope of the Sierra Nevada and the northwestern slope of the Sierra de Perijá. The writer roamed widely over the northern half of the Sierra de Perijá, mostly on the Colombian side, from November 1942 to March 1943, but failed to encounter a single *Cebus*. However, the existence of micos in the area concerned had been reported to him on a few occasions and evidence of their raids on maize fields was noted.

Monkeys recorded as *Cebus apella leucocephalus* by Osgood in 1912 were seen by that author near El Panorama, Río Aurare, Lake Maracaibo, opposite the town of Maracaibo, Venezuela. No specimens were preserved. Cabrera (1917, p. 230) hazarded the opinion that the monkeys were probably *C. nigrivittatus brunneus*. The Río Aurare is so near areas known to be inhabited by *albifrons* and *nigrivittatus* that either species, or both, might occur there. However, Osgood's earlier (1910) and accurate identification of the Orope series as *leucocephalus* is persuasive evidence for regarding micos of the more northern locality as representing the same species, though not necessarily the same race. They are referred, provisionally, to *adustus*.

*Specimens examined*.—Three. Río Cogollo, Zulia, Venezuela, 3 (C.N.H.M.).

**CEBUS ALBIFRONS ALBIFRONS Humboldt**

(Cf. p. 337, for nomenclatorial discussion)

*Simia albifrons* HUMBOLDT, Recueil d'observations de zoologie et d'anatomie comparée, vol. 1, pp. 324–356, 1812 [1811].

*Cebus albifrons*, ELLIOT, A review of the Primates, vol. 2, p. 88, 1913 (part; references to *albifrons* Humboldt only).—CABRERA, Rev. Real. Acad. Cienc., Madrid, vol. 16, ser. 2, p. 228, 1917.—CRUZ LIMA, Mammals of Amazonia, Contrib. Mus. Paraense Emilio Goeldi Hist. Nat. Etnogr., p. 149, 1945 (no distributional records).

*Type*.—No specimens preserved; description most probably based on an individual observed in captivity in Maipures.

*Type locality*.—See Distribution.

*Distribution*.—Said to be the banks of the Orinoco in the region of the cataracts from Maipures to Apures (Venezuelan-Colombian boundary), and the neighborhood of the extinct mission of Santa Barbara near the mouth of the Río Ventuari.

*Characters*.—Known only from original description and comparisons.

“Le Matchi du Haut-Orénoque, que les Indiens Guarekens appellent *Ouavapavi*, a 0. 378 m. (14 pouces) de long du sommet de la tête à l'origine de la queue: il a la face gris-bleuâtre, à l'exception des orbites et du front qui sont d'un blanc pur. Le contraste de ces deux couleurs fait distinguer au premier abord l'*Ouavapavi*, que je désigne sous le nom de *Simia albifrons*, du Saï [*C. nigrivittatus*] et du Sajou ordinaire

[*C. apella*]. La tête est un ovale très-allongé. Le pelage du corps est grisâtre, plus clair vers la poitrine et le ventre, plus obscur vers les extrémités qui sont d'un brun-jaunâtre. Le sommet de la tête est d'un gris tirant sur le noir: une strie cendrée se prolonge longitudinalement de la calotte par le milieu du front vers le nez: les sourcils sont de même d'un gris très-obscur. Les yeux sont grands, bruns et très-vifs. Les oreilles ont un rebord et sont couvertes de poils. La queue est prenante, mais toute couverte de poils, et par conséquent sans callosité: elle est à peu près de la longueur du corps, cendrée par dessus, blanchâtre par dessous, et d'un brun-noir à l'extrémité. Les ongles sont tous arrondis et très-peu convexes. Une strie d'un gris foncé obscur descend le long du dos.

*"Simia albifrons, imberbis, cauda prehensili, ex albo cinerascens, vertice nigro, facie caerulea, fronte et orbitis niveis, cruribus et brachiis fuscescentibus.*

"Les Ouavapavis sont très-lairs, mais extrêmement doux, agiles et moins criards que les Singes pleureurs [*C. nigrivittatus*]. Ils habitent, par troupes, les forêts qui avoisinent les cataractes de l'Orénoque et la mission de Santa Barbara. Nous en avons trouvé un individu à Maypures qui, tous les matins, saisissoit un cochon sur lequel il restoit monté la journée en parcourant la savane qui environne les cabanes des Indiens. Nous l'avons même vu souvent sur le dos d'un chat qui avoit été élevé avec le Singe dans la maison du missionnaire, et qui souffroit patiemment les effets de la pétulance de l'*Ouavapavi*."

*Remarks.*—The above description does not fit any available specimen from the upper Orinoco, the Casiquiare, and upper Rio Negro. No topotypical specimen of *albifrons* has ever been recorded and others which had been assigned to this race are not representative. The brownish-black tip to the otherwise pallid tail of Humboldt's monkey is the chief obstacle to identifying any subsequently recorded member of the *albifrons* group with the type. Only topotypes can establish whether or not the black-tipped tail is a purely individual variation, a racial characteristic, or an inaccurate notation. For the present, material from between the lower Amazon and the Casiquiare is assigned to *unicolor* Spix.

In spite of the inability to identify anything with the subspecies, there is abundant evidence to justify the identity of present material with the species *albifrons*. Three species of *Cebus* range in the upper Orinoco, the Casiquiare and upper Rio Negro regions. These are *apella*, *nigrivittatus*, and *albifrons*. Humboldt (1812, pp. 323-324) compared the three species with each other and emphasized salient diagnostic characters of each. He distinguished *Cebus apella* (with *fatuellus* a simple variety) as the "tufted" monkey with the dark band encircling the face. *C. nigrivittatus*, termed *Simia capucina* by

Humboldt, was regarded as very similar to *C. apella* but paler, body brown mixed with yellow, cap triangular-shaped, tufts and dark facial band absent. The description of *albifrons*, quoted above, is clearly that of a different species and, except for the black-tipped tail, applies to micos here assigned to this species.

*Specimens examined*.—None.

**CEBUS ALBIFRONS UNICOLOR Spix**

(Cf. p. 341 for nomenclatorial discussion)

- Cebus unicolor* SPIX, Simiarum et vespertilionum Brasiliensium, p. 7, pl. 4, 1823.—ELLIOT, A review of the Primates, vol. 2, p. 91, 1913.—CABRERA, Rev. Real Acad. Cienc., Madrid, vol. 16, ser. 2, p. 231, 1917.—CRUZ LIMA, Mammals of Amazonia, Contrib. Mus. Paraense Emilio Goeldi Hist. Nat. Etnogr. (English ed.), p. 150, 1945 (no distributional records).
- Cebus gracilis* SPIX, Simiarum et vespertilionum Brasiliensium, p. 8, pl. 5, 1823 (type locality, Teffé).
- Cebus chrysopus* LESSON, Manuel de mammalogie, p. 55, 1827 (name based on Cuvier's *sajou à pieds dorés*).
- Cebus flavescens* GRAY, Proc. Zool. Soc. London, 1865, p. 827 (Brazil).
- Cebus gracilis* CABRERA, Rev. Real Acad. Cienc., Madrid, vol. 16, ser. 2, p. 229, 1917.—CRUZ LIMA, Mammals of Amazonia, Contrib. Mus. Paraense Emilio Goeldi Hist. Nat. Etnogr. (English ed.), p. 129, pl. 24, 1945 (no distributional records).
- Cebus gracilis* SPIX (vel *C. albifrons* Humboldt ?), Lönnberg, Arkiv Zool., Stockholm, vol. 31A, no. 23, p. 17, 1939 (Rio Solimões; Codajáz; Rio Tapajóz; Irocanga and Patinga; Rio Purús: Jaburú; Rio Juruá: Igarapé de Gordão, João Pessoa, Lago Grande, Santo Antonio, Rio Eirú).
- Cebus albifrons*, ELLIOT, A review of the Primates, vol. 2, p. 88, 1913 (part; *gracilis* Spix, synonym).—TATE, Bull. Amer. Mus. Nat. Hist., vol. 76, p. 213, 1939 (Rio Negro and Río Casiquiare).
- Cebus flavus*, ELLIOT, A review of the Primates, vol. 2, p. 93, 1913 (part; references to Brazilian records).
- C[ebus] c[apucinus] gracilis*, PUSCH, Zeitschr. für Säuget., vol. 16, p. 192, 1941 (part; Amazonian records east of the Andes only and "*C. gracilis* hellstirnig, Lönnberg 1939," not *capucinus* Tschudi and *aequatorialis* Allen).
- C[ebus] c[apucinus] versicolor*, PUSCH, Zeitschr. für Säuget., vol. 16, p. 193, 1941 (part; Brazilian records and "*flavus* Geoffroy" only).
- C[ebus] cuscinus cuscinus*, PUSCH, Zeitschr. für Säuget., vol. 16, p. 196, 1941 (part; "*C. gracilis* dunkelstirnig, Lönnberg," and Chicosa, Peru, only).
- Cebus* species B, THOMAS, Ann. Mag. Nat. Hist., ser. 10, vol. 2, p. 252, 1928 (Cumeria; Chicosa; Cerro Azul; Contamana; Masisea, all localities in Río Ucayali drainage, Peru).

*Holotype*.—Adult male, skin and skull, Zoologische Staatssammlung, Munich; collected by the Spix and Martius Expedition to Brazil.

*Type locality*.—Forests of the Rio Teffé, near its junction with the Amazon, Amazonas, Brazil.

*Distribution*.—Limits unknown but may include all the middle and upper Amazonian region east of the Andes in Brazil, Venezuela (Río Casiquiare), southeastern Colombia, Peru, and Bolivia.

*Characters*.—Most uniformly brightly colored race of *albifrons*.

Cap Snuff Brown to Bister, frontal region buffy to ochraceous; back Ochraceous-Buff to Ochraceous-Orange or Tawny more or less lined with dark brown; sides with less brown, lateral fringe Ochraceous-Buff to Ochraceous-Orange; forearm and foreleg Ochraceous-Buff to Tawny contrasting with dark lining of back; hairs of belly Ochraceous-Buff to Ochraceous-Orange, of chest like belly or white; whitish patch obsolete on front of shoulder.

*Measurements.*—Those of an adult male and female from Solano, Río Casiquiare, followed by those of two adult females from Rio Negro Yavanari and Casas Pereira Igarapé): Head and body, 375, 375; 370, 365; tail, 425, 410; 420, 460; hind foot, 124, 113; 115, 115; greatest length of skull, 94.6, 91.8; 92.1, 91.6; condylobasal length, 71.0, 67.3; 68.4, 69.3; zygomatic breadth, 57.3, 58.6; 57.6, 57.8; width of brain case, 53.6, 51.2; 51.7, 51.0; length of brain case, 73.7, 74.5; 72.7, 70.7; orbital breadth, 49.7, 51.5; 50.3, 50.7; greatest width across maxillary tooth rows, 28.6, 28.5; 29.1, 27.8; length, upper canine to  $M^3$ , 27.3, 26.3; 26.3, 26.0; length, lower canine to  $M_3$ , 30.5, 29.2; 28.9, 27.9; mandibular depth at condyle, 25.2, 25.6; 24.8, 29.0 mm.

*Remarks.*—The above characterization is based on original descriptions and colored plates of *unicolor* and *gracilis*, and eight specimens recorded by Tate (*op. cit.*) as *C. albifrons*. The monkey figured by Spix as *gracilis* is a female. The type of *unicolor* is an old adult male. It was said to differ from *gracilis* by its larger head, generally larger proportions and by the short, stiff gray-banded hairs of limbs and tail. These are differences of age and sex. The described gray ticking is probably the hoar-frosted condition characteristic of many males. This character is not evident, however, in the colored plate. Wagner (1833, p. 991) in critically reviewing the Primates described by Spix, indicated that the two extant specimens of *gracilis* are merely immature representatives of *unicolor*. The types of both *unicolor* and *gracilis* are from Teffé. Available specimens, from four localities along the Rio Negro and the Casiquiare, show slight local differences. Specimens from Yavanari are darkest, especially on outer side of thigh. However, this may be a dark color phase as contrasted with the brightly colored individual from Casas Pereira. Remaining specimens, from the Casiquiare, are intermediate in coloration. The original colored figures of *unicolor* and *gracilis* though not identical with any present specimens, fit very well into the series as a whole.

There is as yet far too little material for a satisfactory determination of the kind of variation these brightly colored monkeys undergo within the vast territory assigned to the range of *unicolor*. Collectively, they are readily distinguished from all other races of *albifrons*. There is a superficial resemblance between *unicolor* and erythristic representatives of "tufted" cebids from eastern Brazil and sometimes



they have been confused with each other. The dark extremities and, usually, the dark facial band, the coronal tufts, especially in the male, always serve to distinguish the "tufted" form from *unicolor*. Cranial characters are, of course, outstandingly diagnostic.

Lönnberg (*op. cit.*) has given an excellent account of 19 specimens of *albifrons* he recorded from the middle Amazonian region. Judged by his descriptions, these micos show a somewhat wider range of variation in color than is given here for the subspecies. It is possible, however, that more than one race is involved in view of the wide distances and the great rivers separating some of the localities where his specimens were taken. Without recognizing it as a purely sexual characteristic, Lönnberg noted that in four females the whole of the frontal area was of approximately the same color as the cap. He attributed this to simple individual variation as other specimens, both male and female with pale colored foreheads were taken in the same localities. Pusch, however, assigned the "dunkelstirnig" females to his "*Cebus cuscinus cuscinus*." The "hellstirnig" specimens he retained as *gracilis*. He elected to list the earlier name *unicolor* as a synonym of *gracilis*.

Specimens from the Río Ucayali region recorded by Thomas (*op. cit.*) as species B, were described as a "paler species with red legs and a whitish tail." They were said to be conspecific with those Thomas described as *Cebus flavescens cuscinus*. This establishes the identity of these micos as *C. albifrons* nearest *unicolor*. It is also probable that the series agrees sufficiently with *chrysopus* to warrant its recognition as a valid race. Pusch examined the specimens in question and referred all but the Chicosa female to *gracilis*. That female was described by Thomas (*op. cit.*) as differing "from the rest by having a somewhat tufted head, with less white on the face." Pusch assigned it to his "species" *cuscinus*. In addition to the above series, Thomas recorded at the same time true "tufted" cebids from the same localities. These were identified by him as species A and described as "a dark species with black legs and black tails." They were said to agree closely with *Cebus fatuellus* [= *apella*] *peruanus* except for the reduction or obsolescence of their tufts. True, the coronal tufts of *C. apella* are not always prominent. Sometimes they consist of only a few hairs raised in form of lines. This condition together with the presence of tufts (of a different character and entirely restricted to females) in "untufted" species from the same localities, caused Thomas (*op. cit.*) to remark that "perhaps the tufts will prove to be an entirely illusory character." Representatives of dark limbed, "tufted" *C. apella* occur throughout most of the range of *C. albifrons unicolor*.

*Specimens examined.*—Thirteen. Marimonda, Río Orinoco, Venezuela, 1 (A.M.N.H.); Solano, Río Casiquiare, Venezuela, 3 (A.M.N.H.); Yavanari, Rio Negro, Brazil, 3 (A.M.N.H.); Casas



Pereira Igarapé, Rio Negro, Brazil, 1 (A.M.N.H.); Puerto Victoria, Río Pachitea, Huanuco, Peru, 2 (C.N.H.M.); Tingo María, Río Huallaga, Huanuco, 2 (C.N.H.M.); no locality, Peru, 1 (C.N.H.M.).

**CEBUS ALBIFRONS YURACUS, new subspecies**

[?] *Cebus griseus*, OSCULATI (*nec* Desmarest), Esplorazione delle regioni equatoriali lungo il Napo . . ., Milan, p. 188, 1850 (Ríos Napo and Curaray).—CORNALIA, *ibid.*, Vertebratorum synopsis, p. 302 (Río Napo).

*C[ebus] albifrons*, CABRERA, Anal. Soc. Española Hist. Nat., Madrid, ser. 2, vol. 29, p. 78, 1900 (La Coca, Río Napo; Río Aguarico; Destacamento, mouth of Río Napo); Trab. Mus. Nac. Cienc. Nat., Madrid, No. 11, p. 25, 1912 (Río Coca; Aguano, Río Napo; Destacamento).—FESTA, Boll. Mus. Zool. Anat. Comp. Torino, vol. 18, No. 435, p. 6, footnote 1, 1903 (specimen in Museo Civico di Milano, probably the same taken by Osculati and identified by Osculati and Cornalia [*op. cit.*, *supra*] as *Cebus griseus*).

*Cebus gracilis*, CABRERA [*nec* Spix], Trab. Mus. Nac. Cienc. Nat., Madrid, ser. zool. No. 31, p. 41, 1917 (Aguano, Río Napo; La Coca, Río Napo; Destacamento, mouth of Río Napo).

*Cebus flavescens cuscinus*, FESTA (*nec* Thomas), Boll. Mus. Zool. Anat. Comp. Torino, vol. 18, No. 435, p. 6, 1903 (part; Granadillas, eastern Ecuador).

*Cebus* sp. cf. *cuscinus* THOMAS, LÖNNBERG, Arkiv Zool., vol. 14, No. 4, p. 6, 1921 (near Río Curaray, eastern Ecuador).

*Cebus castaneus*, RODE (*nec* Geoffroy), Bull. Mus. Nat. Hist. Nat., Paris, ser. 2, vol. 9, p. 343, 1937 (Sigüín, Río Pastaza, eastern Ecuador).

*Holotype*.—Adult female, skin and skull, C.N.H.M. No. 41493; collected February 14, 1932, by Ramón Olalla; original number 66.

*Type locality*.—Montalvo, a site on left bank of Río Bobonaza about 45 kilometers above its junction with the Río Pastaza, an affluent of the Marañón, eastern Ecuador; altitude approximately 500 meters.

*Distribution*.—Territory between Ríos Marañón and Napo, eastern Ecuador and northeastern Peru.

*Characters*.—Most gray fronted (sides of face, chest, outer sides of arms) race of *albifrons*. Generally as in *unicolor* but back ochraceous-brown to Prout's Brown, outer side of forelimb sharply contrasted grayish or buffy; underparts, except of tail, extremely pale, silvery to Ochraceous-Orange.

*Description of holotype*.—Sides of face light Ochraceous-Buff; cinnamon superciliary region with weakly defined brush. Cap Bister; median dorsal region Prout's Brown, sides of back paler grading into Snuff Brown of lateral fringe. Hairs of chest, belly, sides of neck, Light Buff basally, Warm Buff terminally; chin, underside of neck, inner side of forelimb silvery. Outer side of upper arm like side of body, of forearm mixed ochraceous and buffy, anterior (radial) surface of forearm and upper surface of hand, mixed brown and buffy; outer side of hind limb Ochraceous-Tawny, inner side Ochraceous-Buff, upper surface of foot Sayal Brown. Tail above Prout's Brown, beneath Ochraceous-Tawny proximally to Ochraceous-Buff terminally.

*Coloration of paratypes* (old adult male paratopotype; two males, one adult, and one young female from "Río Napo, abajo").—The paratopotype shows least contrast between colors of front and back; sides of face mixed Cinnamon-Buff and Snuff Brown; dark brown cap with line extending to between eyes; median dorsal band Tawny, side of back and lateral fringe Sayal Brown; chin Pinkish Buff, chest Light Buff, hairs of belly Ochraceous-Buff to Ochraceous-Orange terminally, buffy basally; outer side of upper arm Sayal Brown, of forearm paler, inner surface of arm Pinkish Buff proximally becoming Cinnamon-Buff terminally; outer side of hind limb like sides of back, inner side Cinnamon-Buff proximally to Cinnamon terminally; tail Bister above, below Prout's Brown on proximal half, Ochraceous-Orange terminally, the hairs buffy basally. Young female from Río Napo like holotype but without superciliary brush, a midfrontal line present, sides of face paler. Young and adult male from Río Napo paler throughout than holotype.

*Measurements*.—Those of the type followed by those of the male paratopotype: Head and body, 370, 430; tail, 450, 470; hind foot, 122, 140; ear, 35, 40; greatest length of skull, 96.0, 106.7; condylobasal length, 68.1, 81.4; zygomatic breadth, 59.9, 70.2; width of brain case, 53.2, 54.2; length of brain case, 74.7, 82.0; orbital breadth, 49.8, 58.9; greatest width across maxillary tooth rows, 29.0, 32.1; length, upper canine to M<sup>3</sup>, 27.2, 28.5; length, lower canine to M<sub>3</sub>, 29.5, 32.5; mandibular depth at condyle, 24.9, 29.9 mm.

*Remarks*.—The dominantly grayish forearms, face, and underparts of *yuracus* are most distinctive. The blackish limbed, "tufted" *Cebus apella macrocephalus* extends into the range of the present pale-limbed representative of *Cebus albifrons*. Quechua-speaking Indians of the region distinguish the first by the name *yana-machín* (black, or dark, *Cebus*) from the second which they call *yurac-machín* (white or pale, *Cebus*).

*Specimens examined*.—Five. Montalvo, Río Bobonaza, 2 (C.N. H.M.); Río Napo "abajo," eastern Ecuador, 3 (C.N.H.M.).

#### CEBUS ALBIFRONS CUSCINUS Thomas

*Cebus flavescens cuscinus* THOMAS, Ann. Mag. Nat. Hist., ser. 7, vol. 7, p. 179, 1901.—CABRERA, Rev. Real Acad. Cienc. Madrid, vol. 16, ser. 2, p. 229, 1917 (synonym of *gracilis*).

*Cebus unicolor cuscinus*, ELLIOT, A review of the Primates, vol. 2, p. 92, 1913.—THOMAS, Proc. U. S. Nat. Mus., vol. 58, p. 220, 1920 (Uvini, Río Cosireni, 5,000 feet).

*C[ebus] c[uscinus] cuscinus*, PUSCH, Zeitschr. für Säuget., vol. 16, p. 196, 1941 (part; Chicosa, Urubama records only).

*C[ebus] c[apucinus] gracilis*, PUSCH, Zeitschr. für Säuget., vol. 16, p. 192, 1941 (part; Chunchunas, only).

*Holotype*.—Old female, skin and skull, B.M. No. 98.11.6.1; collected April 21, 1898, by Otto Garlepp.

*Type locality*.—Callanga, Río Pinipini, upper Río Madre de Dios, Cuzco, Peru.

*Distribution*.—The Río Urubamba Valley in the department of Cuzco, and the Río Alto Madre de Dios, Peru.

*Characters*.—As in *unicolor* but less brightly colored; limbs more brown, less contrasted with back.

*Uvini, Río Cosireni* (adult male and female): Cap Prout's Brown; anterior half of back Ochraceous-Tawny, posterior half Tawny; sides, lateral fringe, and outer side of upper arm Sayal Brown; forearm Orange-Rufous, wrist and upper surface of hand darker, hairs of fingers mixed buffy and brownish. Outer side of thigh like rump, of foreleg Sanford's Brown in female, mixed Orange-Rufous and Mars Orange in male; upper surface of foot Sanford's Brown to Auburn; undersurface of leg in female Ochraceous-Orange proximally to Orange-Rufous distally. Hairs of belly Ochraceous-Orange and silvery becoming Warm Buff and white on chest; whitish patch on front of shoulder and inner side of upper arm. Tail of male Cinnamon-Brown above, Sayal Brown beneath proximally, becoming Cinnamon Buff terminally; of female Sayal Brown above proximally, becoming slightly paler terminally, beneath Ochraceous-Tawny proximally becoming pale buffy terminally.

The above specimens agree closely with the original description except for color of inner surface of forelimbs, which are "bright rufous to the wrists" in the type. Unlike the male, with a broad pale frontal region sharply defining the dark brown cap, the female has a dark brown frontal diadem continuous with the cap. This is the condition in the type specimen, also a female.

*Measurements*.—Those of an adult male and female from Uvini: Head and body, 400, 390; tail, 440, 475; hind foot, 133, 132; ear 39, 35; greatest length of skull, 96.9, 94.2; condylobasal length, 74.4, 67.8; zygomatic breadth, 63.6, 61.2; width of brain case, 53.9, 53.3; length of brain case, 76.7, 75.7; orbital breadth, 51.0, 49.2; greatest width across maxillary tooth rows, 30.4, 28.7; length, upper canine to  $M^3$ , 28.2, 24.9; length, lower canine to  $M_3$ , 31.5, 29.3; mandibular depth at condyle, 27.3, 26.7 mm.

*Remarks*.—Thomas, in recording the same individuals described above, said that they "agree in every detail with the type and confirm its distinction as a local form." Certain of the collector's measurements of the type reproduced in the original description are obviously incorrect. Head and body length given as 340 mm. seems to be too short for an old adult with skull length of 93.5 mm. Tail length of 390 mm. may also be too short though it is not disproportionate to the given head and body length. Hind foot length of 250 mm. is nearly twice normal size.

The sexually restricted peculiarity of the dark brown frontal region, usually associated with a frontal diadem or tuft, was regarded as a significant specific character by Pusch. As the type is one such female, the only one of the species serving as basis for a name, Pusch assigned all similar females from whatever locality to *cuscinus*. A tufted female from Santa Marta, Colombia, induced Pusch to synonymize *malitiosus* with *cuscinus*. Females with dark foreheads recorded by Lönnberg under *gracilis* (see *unicolor* above), were also assigned by Pusch to *cuscinus*. This sexual character, plus the unusually short head and body length ascribed to the type, may have prompted Pusch (1941, p. 219) into pursuing a complicated sequence of imaginary evolutionary processes in an attempt to demonstrate that *cuscinus* was the most primitive species of the genus and most nearly related to *Aotus*.

*Specimens examined*.—Two. Uvini, Río Cosireni, Cuzco, Peru, 2 (U.S.N.M.).

**CEBUS ALBIFRONS AEQUATORIALIS Allen**

*Cebus chrysopus*, PUCHERAN (*nec* Lesson), Rev. Mag. Zool. Paris, ser. 2, vol. 9, pp. 347–8, 1857 (menagerie specimen said to be from the forests of Guayaquil, Ecuador).

*Cebus albifrons*, FESTA (*nec* Humboldt), Boll. Mus. Zool. Anat. Comp. Torino, vol. 18, p. 6, 1903 (part; Río Peripa and Vinces, Ecuador; *versicolor* and *chrysopus* of Pucheran synonyms).

*Cebus flavescens cuscinus*, FESTA (*nec* Thomas), Boll. Mus. Zool. Anat. Comp. Torino, vol. 18, p. 6, 1903 (part; Vinces, western Ecuador only).

*Cebus aequatorialis* ALLEN, Bull. Amer. Mus. Nat. Hist., vol. 33, p. 654.—LÖNNBERG, Arkiv Zool., Stockholm, vol. 14, No. 4, p. 6, 1921 (Guala, 3,000 and 5,000 ft. altitudes).—CABRERA, Rev. Real Acad. Cienc., Madrid, vol. 16, ser. 2, p. 230, 1917.

*C[ebus] c[apucinus] gracilis*, PUSCH (*nec* Spix), Zeitschr. für Säuget., vol. 16, p. 192, 1941 (part; western Ecuadorian records only: Mindo, Vinces).

*C[ebus] c[apucinus] versicolor*, PUSCH (*nec* Pucheran), Zeitschr. für Säuget., vol. 16, p. 193, 1941 (part; Guayaquil).

*Holotype*.—Adult female, skin and skull, A.M.N.H. No. 34273; collected January 7, 1913, by William B. Richardson.

*Type locality*.—Province of Manaví, western Ecuador; near sea level.

*Distribution*.—Northwestern Ecuador; coast and western slopes of the Cordillera Occidental to not more than 2,000 meters above sea level.

*Characters*.—See original description and literature references.

*Remarks*.—The five original specimens of *aequatorialis*, including one from Guala, recorded by Allen, were examined by the writer but not compared with material described in this paper. Individuals of the coast are brightly colored, like *unicolor*. Those of the mountains are darker. Lönnberg described specimens from Guala as darker than topotypes and suggested that they may represent a darker race

intermediate between *aequatorialis* and *malitiosus*. The altitude of 7,000 feet given by Allen for his Gualea specimen appears to be too high for the range of the species.

It cannot yet be demonstrated where the range of *aequatorialis* meets that of any other member of the species *albifrons*. Possibly it grades into what may be regarded as *hypoleucus* somewhere along the Pacific coast of Colombia. On the other hand, the range of *aequatorialis* meets, if it does not actually overlap, that of *Cebus capucinus* in the mountains of western Ecuador. The writer found the black white-fronted species (*capucinus*) in the vicinity of Paramba (altitude, about 1,000 meters) on the western slope of the Cordillera Occidental, in Ecuador. So far as known, *Cebus capucinus* does not occur on the Ecuadorian coast.

*Specimens examined*.—Five. Manaví, 4 (A.M.N.H.); Gualea, 1 (A.M.N.H.).

**CEBUS ALBIFRONS TRINITATIS** Pusch

*Cebus* sp., THOMAS, Journ. Trinidad Field Nat. Club, vol. 1, p. 159, 1893 (Trinidad).—ALLEN and CHAPMAN, Bull. Amer. Mus. Nat. Hist., vol. 5, p. 231, 1893 (Trinidad).

*Cebus apella*, VESEY-FITZGERALD (*nec* Linnaeus), Tropical Agriculture (Trinidad), vol. 13, No. 6, p. 161, 1936 (Trinity Hills, Trinidad).

*C[ebus] c[apucinus] trinitatis* PUSCH, Zeitschr. für Säuget., vol. 16, p. 194, 1941.

*Holotype*.—Skin of head, a hand and foot, skull, B. M. No. 32.11.17.1; collected by Ballou.

*Type locality*.—Trinidad.

*Distribution*.—Trinidad.

*Characters*.—"Head similar to *C[ebus] c[apucinus] versicolor* but with forehead clearer, more silvery, cap Bister; hand and foot Pinkish Buff to Cinnamon Buff" (a free translation of the original description). A pale form most nearly resembling the pale phase of *cesarae*.

*Nariva Swamp, Trinidad* (immature male, subadult female): Specimens collected in November 1942 by Raymond Shannon. Female in old pelage with patches of Ochraceous-Buff new pelage in sharp contrast, the gray-brown basal portion of the hairs dominating on surface of back and sides; lateral fringe Light Ochraceous-Buff; frontal diadem Light Buff grading into Bister of nape; outer side of forelimb Ochraceous-Buff to Ochraceous-Orange, inner side Warm Buff to silvery; hairs of upper surface of hand and foot mixed brownish, buffy and silvery; outer side of thigh Ochraceous-Tawny, foreleg paler becoming silvery on inner side; tail above like back, beneath Ochraceous-Buff proximally, becoming paler, to Cartridge Buff, terminally; hairs of belly Ochraceous-Buff and silvery becoming more silvery on chest; long ochraceous hairs with brown tips behind nape tend to form a weakly defined mantle. Immature male paler, in good pelage; cap Prout's Brown, nape and interscapular region

Ochraceous-Buff, remainder of back buffy brown, sides paler, lateral fringe Pinkish Buff; outer side of limbs Ochraceous-Buff, inner side paler, to silvery; upper surface of tail Snuff Brown, the hairs with ochraceous tips, undersurface Ochraceous-Buff proximally to silvery terminally.

*Measurements*.—Of an adult male and subadult female: Greatest length of skull, 94.2, 89.8; condylobasal length, 69.2, 64.4; zygomatic breadth, 63.6,—; width of brain case, 49.9, 46.5; length of brain case, 77.4, 72.9; orbital breadth, 54.2, 48.9; greatest width across maxillary tooth rows, 29.4, 27.1; length, upper canine to  $M^3$ , 26.1, 23.9; length, lower canine to  $M_3$ , 29.4, 27.6; mandibular depth at condyle, 28.5, 23.9 mm.

*Remarks*.—Existence of a form of *Cebus* on the island of Trinidad has been known for a long time. Besides the fragmentary type, there is a specimen in the Paris Museum recorded by Pusch, one each in the American Museum of Natural History and the Chicago Natural History Museum; and in the United States National Museum a skull only, in addition to the two individuals described above. Nearest known relatives of *trinitatis* occur in the upper Orinoco region (*albifrons*) and in the Lake Maracaibo region (*adustus*). On the mainland opposite Trinidad, only *C. nigrivittatus* is known. In the Guianas and the lower Orinoco region both *nigrivittatus* and "tufted" *C. apella* further insulate *trinitatis* from other members of its species. There are alternative explanations for this wide gap in the range of the species. Distribution of *C. albifrons* may have been continuous along the Venezuelan coast before separation of Trinidad from the mainland, or the mico was introduced into the island through human agency. The latter theory is the more probable. Wild, living monkeys are known from a number of American islands. *Cebus apella* is represented in Margarita Island, Venezuela, *C. capucinus* in Gorgona Island, Colombia; remains of an *Ateles*, which may have been a household pet, have been found in Cuba. The only other monkey inhabiting the island of Trinidad is the red howler, *Alouatta seniculus insularis*. Isolation of these monkeys can hardly be accounted for on the basis of natural zoogeographical factors.

*Specimens examined*.—Three. Nariva Swamp, Trinidad, 3, one with skull only (U.S.N.M.).

#### GENUS ATELES GEOFFROY: SPIDER MONKEYS, OR MARIMONDAS

The genus *Ateles* has been reviewed recently by Kellogg and Goldman (1944).<sup>3</sup> According to these authors, spider monkeys are repre-

<sup>3</sup> Overlooked by the authors is "*Ateles Beelzebuth* Geoff., Varietas *triangulifera*" Weinland (Zool. Gart. Frankfurt a M., Jahrg. 3, No. 9, pp. 206-207, fig., 1862). The name is based on a menagerie individual of unknown origin. Judged by the description, the type is most probably a representative of one of the Central American races of *Ateles geoffroyi*. For the present, there is no good reason for giving priority to *triangulifera* over any of the later named forms recognized by Kellogg and Goldman.



sented in Colombia as follows: *Ateles belzebuth belzebuth* is found east of the Cordillera Oriental in regions drained by the Orinoco and Amazonas, *A. b. hybridus* occurs in the Río Magdalena, Río Ranchería, and Lake Maracaibo drainage basins, *A. fusciceps robustus* in the Cordillera Occidental, and *Ateles geoffroyi grisescens* (*A. rufiventris* Sclater, a synonym<sup>4</sup>) in northwestern Colombia. The 39 specimens of *A. belzebuth hybridus* collected by the writer in northern Colombia were examined by Kellogg and Goldman (1944, p. 25).

ATELES BELZEBUTH HYBRIDUS I. Geoffroy

*Ateles hybridus* I. GEOFFROY, Mém. Mus. Hist. Nat. Paris, vol. 17, p. 168, 1829; Mag. Zool., Paris, vol. 2, Cl. 1, pl. 1 (1832), 1832 (Magdalena Valley, Colombia).

*Ateles albifrons* Gray, Catalogue of monkeys, lemurs and fruit-eating bats in the collection of the British Museum, p. 44, 1870 (type locality, South America).

[*Ateles belzebuth*] *brunneus* GRAY, Catalogue of monkeys, lemurs, and fruit-eating bats in the collection of the British Museum, p. 44, 1870 (type locality, "Brazil").

*Amer-anthropoides loysi* MONTANDON, Comptes Rendu Acad. Sci. Paris, vol. 188, No. 11, p. 817, 1929 (type locality, left affluent of upper Río Tarra, Venezuela, near the Colombian border).

*Ateles belzebuth hybridus*, KELLOGG and GOLDMAN, Proc. U. S. Nat. Mus., vol. 96, pp. 4, 8, 25, 1944.

*Lectotype*.—Adult female, skin mounted with skull, M.N.H.N. type catalogue No. 75a, accession catalogue No. 519(394). The original description is of "plusieurs femelles et d'un mâle encore jeune." The individual figured in Geoffroy's later description (*op. cit.* 1833, *supra*) is no doubt the original of the one listed by Rode (1938, p. 29) as an adult male and "Holotype." Examination of this specimen reveals it to be an adult female. According to prescribed usage, the specimen should be designated a lectotype. Two cotypes listed by Rode, are number 75b, doubtlessly the "mâle encore jeune" of the original description, and 75c, indicated as a female, is an adult male. The specimens were collected in 1826, by Plée.

*Type locality*.—Types sent to Paris from the Antilles but supposed to have originated in the Río Magdalena Valley, Colombia. Type locality restricted by Kellogg and Goldman (1944, p. 25) to La Gloria, Río Magdalena, a few kilometers above the mouth of the Cesar, department of Magdalena, Colombia; altitude, 45 meters above sea level.

*Distribution*.—In northern Colombia, departments of Magdalena, Atlántico, Bolívar, the Santanders, and extreme southeastern portion of the Guajira; in northwestern Venezuela, from the Sierra de Perijá to Lake Maracaibo.

<sup>4</sup> Type an immature; head, tail, upperparts of trunk and limbs black, chest, belly, inner sides of upper arms and thighs rufous (*ex* type, British Museum).



*Characters*.—Upperparts brown, head, outer sides of forelimbs, and thighs darker than back; forehead with a conspicuous whitish triangular patch; underparts whitish to buffy.

*Variation*.—Variations in color are described under locality headings listed below. No color differences are apparent between sexes; cranium of female slightly more vaulted in frontal region, the brain case slightly less dolichocephalic than in male; canines of male longer and heavier.

A rudimentary thumb is of common occurrence. In most instances, the bony vestige of the thumb is too short to be detected externally as a digit. In one individual from Guaimaral (U.S.N.M. No. 281779) a vestigial thumb bearing a nail appears on each hand. One specimen from the Río Tarra has a vestigial nailless thumb on each hand. Six other individuals show the rudiment on the right hand only. Greater frequency of obsolescence of the left thumb may indicate a tendency toward right-handedness in *Ateles hybridus*.

*La Gloria* (two females): One specimen immature; back of other, a flat skin, nearly entirely bare as result either of faulty preservation or improper tanning. Both specimens agree with the large series form the Río Cesar, described below.

*Remarks*.—Unfortunately the locality designated as typical is represented by poor material. On a geographical basis, however, no better choice could have been made as it is wholly improbable that any other locality from which specimens are available was visited by Plée, collector of the type series. In general, specimens of mammals taken by the writer in La Gloria agree best with corresponding ones secured by Plée. The lectotype of *hybridus* is considerably faded on the left side of body, arm, and foreleg. Otherwise, it is in good condition and agrees completely with average specimens of the Río Cesar series. The adult male cotype in the Paris Museum is darker, more uniformly brown than the lectotype and agrees with darker individuals from the Cesar. The immature male cotype is badly faded but appears to have been grayish or buffy when alive. In this respect it resembles the type of *Ateles albifrons* Gray, which, whatever its original coloration, is now pale buffy with the extremities darker.

The name *hybridus* was elected by Geoffroy on the testimony of Roulin that the vernacular name of the monkey in Colombia is *mono zambo*, or "mulatto" monkey. In Colombia, however, the name *mono* is generally applied to howlers, genus *Alouatta*. The red howler, *A. seniculus*, is known as *mono colorado*, the dark brown howler, *A. palliata*, as *mono zambo*. In Andean countries, *marimonda* is the common criollan name for spider monkeys; *maquisapa* is the Quechua equivalent.

*Guaimaral and El Orinoco, Río Cesar* (9 males, 10 females): Skin of

face black, long white to buffy hairs of cheek directed dorsoposteriad; gray to buffy circumlabial hairs short and sparse; dark brown superciliary hairs long and erect; conspicuous, triangular-shaped frontal patch white to buffy, the long hairs directed forward and converging toward the median line to form a ridge. Crown Snuff Brown to Bister, the hairs directed forward and overlapping frontal patch. Nape like crown or slightly paler, the hairs directed forward; scapular region paler, from Snuff Brown to Cinnamon-Buff; the hairs forming a whorl; back becoming progressively paler posteriorward, to Pinkish Buff or Light Buff in palest individuals. Lateral fringe like back. Chest, belly, inner side of thigh and ventral surface of tail, except naked terminal one-fourth, sharply defined silvery or buffy, the dark brown skin showing through. Forelimb dark brown like nape or crown, the inner side pale, like chest; outer side of thigh like forelimb, contrasting with pale lower part of back and rump; dark brown of thigh extending on outer side of leg as a band bordered by buffy hairs. Upper surface of tail brown like back, or darker, with terminal one-fourth usually darker than anterior portion.

*Río San Pedro, Norosí* (one adult female): Darkest specimen of the collection with head and forelimbs almost black; most nearly approached in color by a large male of the Río Cesar series. This heavily pigmented female may represent a dark race isolated from the typical population on opposite side of the Río Magdalena.

*Las Marimondas* (2 males, 6 females): Like the Río Cesar series but slightly more uniformly brown. One immature, combined head and body length, 188 mm., is thinly haired dirty gray on upperparts. Another immature, head and body, 226 mm., is colored like adults but with the buffy juvenile pelage still evident. Frontal patch is not defined in either juvenal.

*Remarks.*—The name *Las Marimondas* was given by natives to this locality in the Sierra de Perijá because of the abundance of spider monkeys, or *marimondas*, there. Few bands of *Ateles* still remain on the western slope of the whole range. Deforestation and persecution by man forced spider monkeys to retreat to the summits and eastern slopes of the Sierra de Perijá. Individuals of the present series were taken on the western slope, in the Río Ranchería drainage system, and on the eastern, or Venezuelan slope, in the Lake Maracaibo system.

*Río Tarra* (2 males, 7 females): Like the Cesar series but more uniformly colored, less variable individually; average size larger.

*Remarks.*—Five specimens were taken at Bella Vista, altitude 400 meters, on heights overlooking the author's Tarra camp; the remaining four in the Río Tarra Valley at an altitude of about 200 meters above sea level. The Río Tarra of these spider monkeys is not the same as

the Río Tarra of *Amer-anthropoides loysi*. Both streams are in the same general region on the Colombian-Venezuelan border, both flow in the same direction about 40 kilometers apart and empty into the Río Catatumbo. Spider monkeys collected here are representative of *Amer-anthropoides loysi*, as well as identical with those taken in the Río Magdalena Valley. Various authors have already indicated the identity of *Amer-anthropoides* with *Ateles*. On the basis of the present series Kellogg and Goldman (1944, p. 27) have shown *loysi* to be a synonym of *Ateles belzebuth hybridus*.

#### GENUS ALOUATTA LACEPÈDE: HOWLERS

Colombian representatives of *Alouatta* are the red *A. seniculus seniculus* Linnaeus and the blackish *A. palliata aequatorialis* Festa. Only the red howler was found by the author in northern Colombia. The 60 examples taken are compared with *A. palliata* and listed and described by localities. A separate section of this report is devoted to a description of the hyoid apparatus of howlers.

#### ALOUATTA SENICULUS SENICULUS Linnaeus

*Simia seniculus* LINNAEUS, *Systema naturae*, ed. 12, p. 37, 1766.

*Stentor chrysurus* I. GEOFFROY, *Mém. Mus. Hist. Nat. Paris*, vol. 17, p. 166, (1828) 1829; *Mag. Zool.*, Cl. 1, pl. 7, 1832.

*Mycetes laniger* GRAY, *Ann. Mag. Nat. Hist.*, vol. 16, p. 219, 1845 (type locality, Colombia).

*Alouatta seniculus rubicunda* ALLEN, *Bull. Amer. Mus. Nat. Hist.*, vol. 20, p. 458, figs. 1, 3 (with captions, "*rubiginosa*," *lapsus calami* for *rubicunda*) 1904 (type locality, Bonda, near Santa Marta, Colombia).

*Alouatta seniculus caucensis* Allen, *Bull. Amer. Mus. Nat. Hist.*, vol. 20, p. 462, figs. 2, 4, 1904 (type locality, Charingo, upper Cauca Valley, Colombia).

*Alouatta seniculus bogotensis* ALLEN, *Bull. Amer. Mus. Nat. Hist.*, vol. 33, p. 648, 1914 (type locality, Suba, Cundinamarca, Colombia).

*Alouatta seniculus caquetensis* Allen, *Bull. Amer. Mus. Nat. Hist.*, vol. 33, p. 650, 1914 (type locality, La Muralla, Caquetá, Colombia).

*Type locality*.—"Cartagenae in silvis ad fluvium," department of Bolívar, Colombia. Lönnberg (1941, p. 8) attempted to prove that the type locality should be French Guiana. His argument was founded on the reference by Linnaeus to *le singe rouge de Cayenne* of Brisson (1756, p. 206), and his apprehension that the red howler of Cartagena might be specifically distinct from that of the Guianas. Such is not the case. All red howlers of northwestern South America are conspecific, and the typical form, by Linnaeus' own restriction, is the one inhabiting the Cartagena region. Cruz Lima (1945, p. 66) discussed and rejected Lönnberg's change of venue. As authority for the Colombian habitat of *seniculus*, Linnaeus cited the collector and botanist Jacquin. Humboldt (1812, p. 342) added the following information: "Le singe appelé *Mono colorado* ou *Singe rouge* à Cartha-

gène des Indes et sur les rives du grand fleuve de la Madeleine, est le *Simia seniculus* de Linné. Le synonyme de Jacquin, rapporté dans le *Systema Naturae*, ne laisse aucun doute sur cette identité, et le célèbre botaniste de Vienne a trouvé ce *Hurleur* à peu près dans le même endroit que nous l'avons trouvé, lorsque nous remontâmes à Mompox par la digue de Mahates." The Canal de Mahates is one of the navigable lower channels of the Río Magdalena that empties into the sea south of Cartagena.

*Distribution*.—Wooded areas of northwestern South America; from northern Chocó and the Santa Marta region in northwestern Colombia east into western Venezuela, thence south in eastern Colombia, eastern Ecuador and across the Amazon into southwestern Brazil and north-eastern Peru.<sup>5</sup>

The red howler occurs throughout Colombia, except in the southwestern portion, from sea level to approximately 2,000 meters above. There are records of both *seniculus* and *A. palliata* from the Cartagena region south to the Río Sinu, from the Río Atrato, and from the Darién in the Chocó.<sup>6</sup> Only *A. palliata* is known from Panama northward and from farther south along the coast of Colombia and Ecuador. The red howler, as in the case of many species of Brazilian origin, crossed the northeastern extremities of the Andes and introduced itself into the Lake Maracaibo drainage basin and the valley of the Río Ranchería in Colombia, thence south into the Cauca-Magdalena and the Atrato drainage basins. This species, while not necessarily the first to enter any area, is certainly among the last of the monkeys to leave it. It is found high and above the altitudinal limits of any other kind of monkey, except possibly *Aotus*, with which it may be found in association at lower altitudes. In areas where all other species of monkeys have been driven out or caused to disappear because of deforestation or isolation from principal sources of food, the red howler may still be found occupying the last isolated stands of timber. Riverine islands are more apt to be inhabited by red howlers than by any other species of monkey.

*Habitat versus geographical variation*.—The red howler is a comparatively sedentary animal, sluggish in movement, conservative in habits. Combined with its great ability to survive environmental fluctuations is its small capacity for adaptation to such changes. Under normal environmental conditions this howler, with its enormous vitality and almost complete freedom from predators, will flourish. Its natural

<sup>5</sup> *Alouatta macconnelli* Elliot and *A. seniculus amazonica* Lönnberg are not distinguishable from *straminea* which, in turn, is but weakly differentiated from typical *seniculus*. It is doubtful that *juara* Elliot (*jurua* Lönnberg, a synonym) and *puruensis* Lönnberg can be separated from *seniculus*. *A. seniculus sara* Elliot, from Sara, Bolivia, and *A. s. insularis* Elliot of Trinidad, appear to be valid subspecies.

<sup>6</sup> In the U. S. National Museum, five specimens of *A. seniculus* and two of *A. palliata aequatorialis* from the lower Atrato and Río Truandó, collected by A. Schott; in the Carnegie Museum, one specimen of *A. p. aequatorialis* from Turbaco, near Cartagena, and two from Lorica at the mouth of the Sinú, collected by M. A. Carriker, Jr.

habitat is the *selva* rich with food and water. However, many series of red howlers taken by the writer appeared to be remnants of erst-while large populations, confined to small relicts, or facsimiles thereof, of primary forest. In these delimited and altered habitats individual clans of howlers have become isolated from the mass of the population. With continued deforestation these clans will be exterminated. Individuals do persist, however, as long as nature provides them with a suitable tree and its fruit. Unlike their more resourceful, or more adaptative relatives, howlers do not ordinarily supplement their ever-diminishing natural larder with loot from cultivated fields circumscribing their domain. They simply eat less and travel less. Their growth becomes stunted, their resistance to disease and parasites reduced. At the same time they fall easier to predators and become more frequent targets for indiscriminate killing by man. Physical characters of these detached remnants of an otherwise numerous and powerful race are not indications of geographical variation or subspeciation but, rather, of localized degeneration.

*Comparisons.*—Superficially, the brightly colored, reddish howler, *Alouatta seniculus*, is immediately distinguished from the smaller, blackish *A. palliata*, the only other species of howler found in Colombia (and Ecuador). Striking differences in structure of the hyoid bones of these species is described in a following section. Cranial characters distinguishing the two are not so obvious or so easily defined as external and hyoidal ones. In *seniculus* the skull is longer and relatively narrower, rostrum more projecting, shallow concavity of nasals usually evenly curved from tips to between orbits; in *palliata*, the rostrum is compressed anteroposteriorly, the nasals usually forming an angle between orbital and maxillary regions; ratio of zygomatic breadth to condylobasal length in *seniculus* 63 to 77 percent (60 specimens, northern Colombia), in *palliata* 74 to 83 percent (20 specimens); sphenomaxillary fissure long, well opened in *palliata*, usually reduced or obsolete in *seniculus*; mesopterygoid fossa in *seniculus* widely opened, the walls nearly parallel-sided, distance between bases of hamular processes normally equal to or greater than distance across incisors or crown lengths of either  $P^{2-4}$  or  $M^{1-2}$ ; hamular processes usually slender and elongate, directed back as well as down with tapered tips tending to recurve upward; mesopterygoid fossa in *palliata* narrower, the walls markedly convergent, with distance between bases of hamular processes equal to or less than distance across incisors or crown lengths of either  $P^{2-4}$  or  $M^{1-2}$ ; hamular processes usually short, comparatively broad and bent sharply downward with tips expanded and truncate; foramen magnum in *seniculus* usually subtriangular in outline and higher than wide; in *palliata*, foramen magnum usually subcircular or ovate and as wide or wider than high, the occipital condyles markedly weaker than in *seniculus*



Hyoid bones of adult howlers, genus *Alouatta* (all natural size): *a*, *b*, *Alouatta seniculus seniculus*, males, from northern Colombia, showing variation in shape of bullar and tentorial chambers; *c*, *A. s. seniculus*, female, from northern Colombia; *d*, *A. palliata inconsonans*, male, from Panamá.





Most cranial differences cited by Tate (1939, p. 216) for distinguishing *A. seniculus* from *A. palliata* have been found to be either excessively variable or not applicable to the species in question. Measurements of molariform teeth reveal no significant differences between the two species. Dimensions given by Tate for outer width of incisors ( $I^1$ – $I^2$ ), 16 mm. in *palliata* and 17.5 mm. in *seniculus*, compare with a range of 13.7 to 15.5 mm. in 20 specimens of the former and 12.6 to 17.2 mm. in 75 specimens of the latter. Opening of malar foramen in Tate's specimens is 2.5 mm. in *palliata* and 7 to 8 mm. in *seniculus*. In present material the opening varies from 2.1 to 5.5 in *palliata* and 2.9 to 6.0 in *seniculus*. The shape of the postglenoid process is in most cases, especially in females, much more ligulate in *palliata* than in *seniculus*, a difference quite the reverse of that given by Tate.

*Sexual dimorphism.*—The fully adult male with its larger, more robust head and body, its thick lower jaw, and swollen throat covered with a long heavy beard, can always be distinguished from the female, even at a distance. The smallest normal adult male is usually larger than the largest normal adult female of the same series, in nearly all measurements. Tail length is the most notable exception. In females the tail is nearly always relatively longer and, frequently, actually longer than that of some males of the same series. Tail in females averages 56 percent of total length; in males 54 percent. Proportionate length of tails of juvenals is about 58 percent in both sexes. Notable differences between sexes in size and structure of hyoid bone are described later. The sexes do not differ in color or color pattern.

In addition to size, the usual cranial differences between sexes are apparent. In males the canines are longer and thicker, temporal crests more developed and approximated, brain case lower, heavier, and more dolichocephalic, bony rims of orbits heavier, mandible larger, etc.

*Description.*—Diagnostic characters of the skull have been given, and the hyoid apparatus of *seniculus* is described hereinafter (p. 394). Coloration and measurements of the species are represented by the following descriptions of each series of red howlers collected in northern Colombia by the author. A total of 60 specimens (32 males, 28 females) are described, in addition to 6 topotypes of *rubicunda* Allen, from Bonda, Santa Marta, collected by Mrs. Herbert H. Smith. All specimens listed may be regarded as typical. Variations in color are greatest between age groups, and greater between extremes of any one series than between the average of each of any two series. In no case, however, is the range of variation in color great in any one series. Variation depends principally upon color of hair tips of back. Extent of the pale or dark tipping determines whether an individual is described as being, respectively, in light or dark color phase. Color

of basal portion of hairs is extremely variable in any series and in any one specimen. Generally, however, these are darker in young and very immature individuals than in adults. Cranial characters are, by far, most variable. Skull characters employed by Allen for separating various forms of red howlers described by him are patently individually variable. The few cranial measurements, and the external ones as well, given below may be useful for comparisons with measurements of other species of howlers. They are of no value for differentiating one series from another. In the majority of cases individual measurements represent specimens which, though all adults, are not strictly comparable because of the many peculiarities of the individual, the family or the clan that are linked to them. Highly localized environmental conditions, such as quality and availability of food and water, are of greater significance in growth and development of these very sedentary and sluggish monkeys than in any other species of American simian.

*Cerro de la Guayta, near Ciénaga de Guájaro* (3 males, 1 subadult; 2 females): Back, between shoulders and rump, Ochraceous-Orange to Xanthine-Orange with the yellower, or buffy, subterminal bands of hairs showing through at surface; basal portions of hairs Ochraceous-Tawny to Cinnamon-Brown. Hairs of lateral fringe like back but longer, especially the Burnt Sienna terminal portions which nearly completely cover the paler proximal portions. Hairs of rump Sanford's Brown to Burnt Sienna terminally, becoming increasingly paler basally except near roots which may be brownish. Interscapular region Burnt Sienna to Mahogany Red or Chestnut in appearance, the Orange-Rufous to Sanford's Brown terminal halves of hairs broken by a Burnt Sienna to Chestnut subterminal band, upper part of basal portion of hairs like tips or slightly paler, lower part darker, becoming dark brown toward roots. Head, chin, fore and hind limbs more or less uniformly Burnt Sienna to Chestnut. Proximal portion of tail like hind limbs, terminally paler, Mars Orange to Xanthine Orange. Hairs of underparts Burnt Sienna to Chestnut.

*Measurements.*—Those of an adult male and female, respectively: Head and body, 465, 475; tail, 645, 646; hind foot, 146, 142; greatest length of skull, 118.3, 101.5; condylobasal length, 110.1, 93.6; length of brain case, 76.6, 63.4; mastoidal width of brain case, 54.7, —; length of maxillary tooth row (C-M<sup>3</sup>), 39.0, 35.4 mm.

*Remarks.*—The series was taken in the low hill country about midway between Barranquilla and Cartagena and is strictly representative of the original Linnaean *seniculus*. All skulls of the series are damaged. The foregoing measurements are of the two best-preserved specimens. The skull of one adult female is malformed as the result of an injury it must have received in early life. In this

specimen, squamosal process of zygomatic arch and glenoid process of left side are absent. Posterior portion of jugal, together with a remaining fragment of squamous portion have formed a new articulation with temporal portion of brain case. As an accommodation for the shortened arch, the rostrum is distorted to the left. Premolars of left side are bunched together with last (?) premolar situated lingually between first and second. There is a diastema between  $PM^3$  and  $M^1$ .

*Río San Pedro, Norosí* (3 adult females): Indistinguishable from the above except rumps average slightly darker, more differentiated from middle portion of back.

*Measurements.*—Head and body, 519, 521, 515; tail, 605, 629, 612; hind foot, 146, 140, 159; ear, 34, 34, 39; greatest length of skull, 106.3, 106.5, 109.6; condylobasal length, 96.8, 96.3, 99.1; zygomatic breadth, 66.3, 67.8, 69.4; length of brain case, 67.9, 67.4, 68.0; mastoidal width of brain case, 50.1, 57.5, 52.1; greatest width across maxillary tooth rows, 34.1, 37.7, 36.3; length of maxillary tooth row (C-M<sup>3</sup>), 39.8, 37.5, 39.6 mm.

*Remarks.*—The specimens were taken in the foothills of the Cordillera Central at an altitude between 150 and 175 meters above sea level.

*La Gloria, Río Magdalena* (2 males, 1 immature; 1 female): Practically identical with the Río San Pedro series except base of hairs of middle part of back paler in adult male, darker in immature, and lower half of lateral fringe of immature not sharply defined from side of body.

*Measurements.*—Those of the adult male followed by those of the female: Head and body, 534, 477; tail, 559 (imperfect), 633; hind foot, 152, 130; ear, 36, 33; greatest length of skull, 118.6, 100.7; condylobasal length, 110.2, 89.1; zygomatic breadth, 77.8, 66.8; length of brain case, 76.6, 69.7; mastoidal width of brain case, 59.3, 50.9; greatest width across maxillary tooth rows, 39.2, 35.7; length of maxillary tooth row, 40.8, 38.9 mm.

*Remarks.*—The original series of *Stentor chrysurus* Geoffroy, consisting of two adults and one immature, was collected by Plée and sent from the Antilles in 1826 after the collector's death. Only the adults, both mounted, are still preserved in the Paris Museum. No original data accompanied the specimens except for a tag attached to one of them with the notation that its local name was *araguato*. This is the name by which the red howler is known in Venezuela. Natives of Colombia call this monkey *mono colorado*, or simply *mono*. Plée could have become familiar with the name *araguato* during his sojourn in Venezuela and, later, applied the term to the howlers collected in Colombia. It has been shown that other mammals collected by Plée

(*Sciurus variabilis*, *Ateles hybridus*, *Cebus albifrons pleei*) agree with the fauna of the lower Río Magdalena, and *Alouatta chrysurus* can likewise be matched with present specimens of howlers from La Gloria and Río San Pedro, Norosí. The *araguato* of Venezuela, described by Humboldt as *ursina* (= *arctoidea* Cabrera), is a darker race. Geoffroy himself believed the true habitat of *chrysurus* to be the Magdalena Valley of Colombia. Original distinction of *chrysurus* from *seniculus* was based on comparisons with Guianan specimens supposed to be representative of typical *seniculus*. The colored figure of *chrysurus* (*op. cit.*) may be identified as that of a red howler but otherwise has little resemblance to the actual specimens it is supposed to depict.

*Bonda* (4 males, 2 females): The males similar to the Ciénaga de Guájaro series, but two with darker rumps, two with paler rumps; females in pale phase, dark tipping of hairs of back greatly reduced, terminal halves of hairs like subterminal portions of hairs of backs of males, tail also paler for greater length.

*Measurements*.—Those of an adult male and female, respectively, external measurements not available: Greatest length of skull, 128.3, 109.4; condylobasal length, 122.5, 98.1; zygomatic breadth, 84.6, 68.9; length of brain case, 80.0, 71.4; mastoidal width of brain case, 63.3, 52.7; greatest width across maxillary tooth rows, 44.1, 37.8; length of maxillary tooth row, 43.5, 39.3 mm.

*Remarks*.—These are topotypes of *rubicunda* Allen, collected by Mrs. H. H. Smith. As in the case of *chrysurus*, separation of *rubicunda* from true *seniculus* was predicated on the assumption that the type locality of the latter was in the Guianas. Later, in his description of *bogotensis*, Allen (*op. cit.*) affirmed it to be Cartagena, Colombia. The first account of *rubicunda* deals lengthily with the considerable amount of individual variation noted among the 84 specimens of the type series.

*Colonia Agrícola de Caracolicito* (2 males, 1 immature; 2 females, 1 immature): Adult male in pale phase, adult female slightly darker, with more dark-tipped hairs on back. Immature female with basal portions of hairs of dorsal surface except rump, nearly black, hairs of face and chin darker than usual, arms with a blackish lateral line. Immature male smaller than the female, paler throughout but basal portions of hairs of back still darker than in adults.

*Measurements*.—Those of an adult male and female, respectively: Head and body, 581, 505; tail, 674, 645; hind foot, 155, 142; ear, 39, 36; greatest length of skull, 125.9, 106.2; condylobasal length, 113.3, 95.7; zygomatic breadth, 78.3, 65.3; length of brain case, 79.8, 67.5; mastoidal width of brain case, 58.0, 49.0; greatest width across maxillary tooth rows, 39.6, 35.1; length of maxillary tooth row, 41.1, 37.9 mm.

*El Salado* (2 males, 2 females): One male like the adult female from Colonia Agrícola, other specimens darker and indistinguishable from the Ciénaga de Guájaro series.

*Measurements*.—Those of 2 males and 2 females, respectively: Head and body, 511, 546, 573, 493; tail, 555, 615, 643, 606; hind foot, 145, 155, 146, 144; ear, 36, 38, 36, 35; greatest length of skull, 114.1 111.3, 107.5, 107.1; condylobasal length, 108.1, 107.3, 96.7, 96.0; zygomatic breadth, 80.0, 72.2, 70.4, 66.2; length of brain case, 69.2 68.5, 69.2, 69.4; mastoidal width of brain case, 53.6, 56.2, 53.3, 49.7; greatest width across maxillary tooth rows, 39.2, 41.1, 36.4, 34.7; length of maxillary tooth row, 44.5, 41.8, 37.5, 36.9 mm.

*Río Cesar* (8 males, 1 immature; 9 females, 2 immature): Most males are in pale phase but average paler than similar individuals of the other series mentioned; most females with hairs of back dark tipped but average slightly paler than the San Pedro and Ciénaga de Guájaro series. Basal portions of hairs of dorsal surface are generally darker in immature or young than in fully adult individuals. The series was taken from August 20 to October 16, 1942, during the rainy season. There is no apparent relationship between date of capture and color phase.

*Measurements*.—Means and extremes of 7 adult males followed by those of 7 adult females: Head and body, 534 (522–552), 473 (459–501); tail, 657 (602–690), 619 (571–670); ratio of tail length to total length, 55 percent (51–56 percent), 57 percent (54–60 percent); hind foot, 153 (150–160), 143 (138–153); ear, 37 (35–41), 34 (32–36); greatest length of skull, 117.6 (115.6–120.7), 103.2 (101.0–106.3); condylobasal length, 109.4 (107.8–111.6), 92.4 (90.2–94.3); zygomatic breadth, 77.4 (73.0–81.5), 66.1 (62.7–67.7); length of brain case, 74.4 (71.8–77.8), 67.5 (66.4–69.1); mastoidal width of brain case, 56.6 (54.6–58.5), 49.8 (48.2–51.8); greatest width across maxillary tooth rows, 38.0 (36.3–39.8), 35.4 (34.2–36.8); length of maxillary tooth row, 42.4 (40.5–44.1), 35.4 (34.2–36.8) mm.

*Villanueva* (6 males, two immature; 6 females, one immature): Three males and two females may be classified as pale phase individuals. These do not appear to be quite as pale as the same category of individuals from the Río Cesar. The remaining dark specimens are like those from the Cesar. Altogether, they average slightly darker than the Cesar series. This is the reverse of what has been observed heretofore in comparing other species of mammals from the two localities. The series was taken from January 22 to February 16, 1943, during the dry season.

*Measurements*.—Those of 3 males and 4 females, respectively: Head and body, 531, 493, 544; 510, 490, 490, 478; tail, 602, 552, 574; 578, 578, 613, 549; hind foot, 155, 140, 143; 143, 132, 143, 145; ear, 36, 34,

35; 35, 35, 36, 32; greatest length of skull, 112.9, 107.4, 111.7; 102.4, 98.4, 102.6, 104.5; condylobasal length, 107.4, 98.4, 105.8; 95.8, 88.4, 97.0, 93.0; zygomatic breadth, —, 69.5, 74.4; 67.9, 64.4, 65.6, 65.2; length of brain case, 74.7, 71.5, 69.1; 66.0, 65.6, 67.5, 69.6; mastoidal width of brain case, 56.5, 51.8, 55.5; 52.3, 48.7, 50.4, 49.5; greatest width across maxillary tooth rows, —, 39.1, 37.4; 35.1, 33.3, 35.3, 35.7; length of maxillary tooth row, 42.1, 42.3, 41.0; 40.0, 36.9, 36.2, 39.6 mm.

*Las Marimondas, Sierra de Perijá* (5 males, 1 immature; 2 females): Like those from La Gloria, San Pedro, and Ciénaga de Guájaro except pelage longer and more lustrous, lateral fringe and extremities, especially tail, slightly darker.

*Measurements.*—Those of 4 males and 2 females, respectively: Head and body, 548, 574, 534, 540; 481, 509; tail, 629, 619, 598, 604 (bob); 605, 654; hind foot, 154, 155, 142, 154; 131, 143; ear, 35, 36, 38, 39; 35, 36; greatest length of skull, 116.2, 121.7, 117.3, 127.5; 107.5, 107.5; condylobasal length, 109.2, 112.6, 110.9, 120.3; 97.9, 97.6; zygomatic breadth, 74.7, 80.2, 78.2, 83.9; 67.2, 68.9; length of brain case, 70.6, 76.8, 73.1, 79.1; 69.6, 70.6; mastoidal width of brain case, 55.9, 60.0, 54.3, 62.2; 50.1, 51.8; greatest width across maxillary tooth rows, 40.2, 41.5, 39.6, 47.7; 36.5, 37.1; length of maxillary tooth row, 41.5, 45.0, 41.5, 43.7; 39.7, 38.9 mm.

*Remarks.*—Cranial measurements of another howler from the Sierra Negra, south of Las Marimondas and above the town of Villanueva are roughly intermediate between those of the two largest males of the above series.

*Río Tarra* (3 males, 1 female): Like the Las Marimondas series but pelage glossier, extremities slightly darker.

*Measurements.*—Those of 3 males and 1 female, respectively: Head and body, 538, 565, 606; 537; tail, 748, 705, 643; 673; hind foot, 171, 162, 152; 157; ear, 39, 39, 37; 34; greatest length of skull, 124.8, 126.3, 130.7; —; condylobasal length, 113.3, 118.3, 122.5; 104.3; zygomatic breadth, 76.5, 84.9, 80.6; 66.6; length of brain case, 81.2, 81.6, 83.5; 72.3; mastoidal width of brain case, 57.8, 57.9, 59.6; 52.8; greatest width across maxillary tooth rows, 44.0, 42.8, 41.0; 35.7; length of maxillary tooth row, 44.5, 43.5, 43.5; — mm.

*Remarks.*—These howlers are by far the largest of the collection. The series from Las Marimondas, in the same general region, averages slightly smaller. Both series are the only ones taken in humid virgin forest. The others are from secondary forests in humid or semiarid climates. The Villanueva and Ciénaga de Guájaro regions are semiarid and largely savanna with isolated stands of scrub forests marked by relatively few tall trees. Apparently, conditions in humid virgin forests are optimum for maximum growth and development of howlers. Of some taxonomic interest is the tendency for the Las Marimondas



and Tarra howlers to be darker than the others. This may indicate intergradation with the distinctly darker *arctoidea* Cabrera (for *ursina* Humboldt, preoccupied). One available specimen of the latter from the Paría Peninsula, northern Venezuela, is almost blackish in contrast with typical representatives of *seniculus*.

The female skull of the present series is imperfect. An injury to the left side resulted in a fracture of the maxillary and lachrymal portions of the zygomatic arch as well as damage to the orbit itself. The monkey had evidently recovered from the effects of the injury though the wound itself appears to be no more than half healed.

It is rather curious that the only howlers of the collection with important cranial injuries are two females with damaged left zygomatic arches. To this may be added another female of the *A. palliata* group used in this report for comparisons, also with a damaged left arch.

#### HYOID BONE OF HOWLERS, GENUS *ALOUATTA*

Hyoid bones of *Alouatta seniculus* (32 males, 28 females) collected by the author in northern Colombia form the principal basis for the following descriptions. Other hyoids of *A. seniculus* from throughout the range of the species have been examined. Further comparisons have been made with hyoids of three males and one female of *A. palliata*, of one male of *belzebul*, of two females of *nigerrima*, of a male and female of *fusca*, and of a male of *caraya*.<sup>7</sup>

The value of the hyoidan structure for classifying species of *Alouatta* was first demonstrated by Ihering (1914). His material consisted of several hyoids representing *seniculus*, *belzebul*, *fusca*, and *caraya*. Lönnberg (1941, pp. 2-5) also made a study of howler hyoids. He described and figured those of a few males of *A. seniculus*, one each from the following localities: Rio Juruá, Brazil; Surinam; Rio Jahu, east of Rio Negro, Brazil; Guamal, on northern frontier between Colombia and Venezuela; and Cartagena, Colombia. Specimens from the first two localities were identified, respectively, as *A. seniculus juruana* and *A. seniculus seniculus*. Those of the last three localities were regarded as different with each representing a possibly distinct species. This conclusion does not appear to be tenable. Lönnberg's published figures of the different kinds of hyoid bones of red howlers of the *seniculus* group hardly show the full range of variation that exists in any large series of *A. seniculus*. The same author also described and figured (*op. cit.*, pp. 24-25, pl. 3, figs. 6a-b) the male hyoid bone of *A. beniensis*, a red howler of the *A. fusca* group. Cruz Lima (1945, pp. 68-69) included some characters of the hyoid in his key to the Amazonian howlers, *A. seniculus*, *belzebul*, and *nigerrima*.

<sup>7</sup> Except for the hyoid of one *A. palliata*, all specimens of the last-mentioned species are in the collection of the Chicago Natural History Museum.



## ALOUATTA SENICULUS SENICULUS

PLATE 17, *a-c*; FIGURE 55

*Description.*—Hyoid (os basihyale) of adult male is a large thin-walled subglobular capsule. Main chamber of hyoid, the bulla, opens behind; width of opening about one-half or less greatest length of bulla; lateral and lower borders of opening subcircular in outline, the rim rounded and, usually, sloping inward. Upper border of opening bounded by rim of a large, rounded, and well-inflated subchamber, the tentorium. Each upper corner, or side, of tentorium marked by a large articular depression for thyreohyal bone. Inner lateral surface of tentorium defined from bulla by bony plates. Each outer side of opening usually provided with a rudimentary cornicule for attachment of stylohyoid ligament; base of cornicule often swollen or inflated. A median ventral plate, sometimes only a line, parts inner surface of bulla. Width and depth of smallest adult hyoid bone examined are 38 by 55 mm., of largest, 55 by 80 mm.

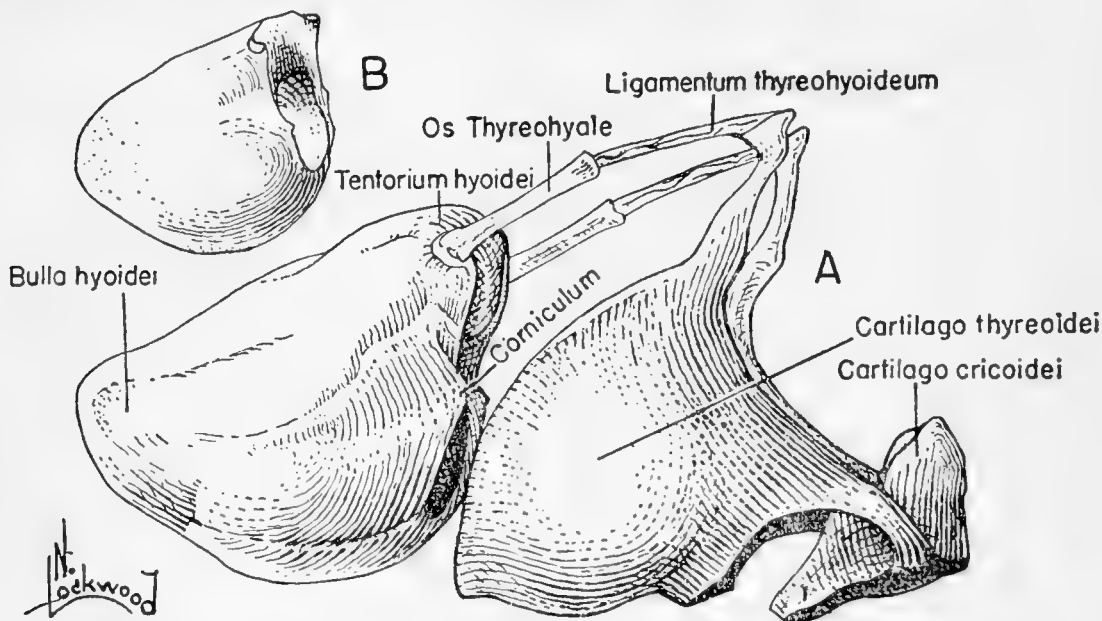


FIGURE 55.—Hyobranchial apparatus of adult red howler, *Alouatta seniculus seniculus* (natural size): *A*, Male apparatus with bullar and tentorial chambers of hyoid bone (os basihyale) indicated; *B*, female hyoid bone. Fusion of thyreohyal bone and cornu (not found in *seniculus*, cf. *straminea* ♂, fig. 56) form the “cornu majus” of human anatomy.

Female hyoid considerably smaller, less inflated, hence more rectangular in outline; whole inner surface, of bulla and tentorium combined, smooth and without partitions; cornicula slightly more projecting than in male but hardly, or not at all, swollen basally; rim of opening plane, not sloping inward as in male. Dimensions of smallest female hyoid examined, approximately 22 by 38 mm., of largest, 27 by 45 mm. Volume of largest female hyoid between one-fourth and one-fifth that of largest male hyoid.

*Variation.*—Size and shape of hyoid vary individually and with age. Dimensions are roughly proportional to those of the space

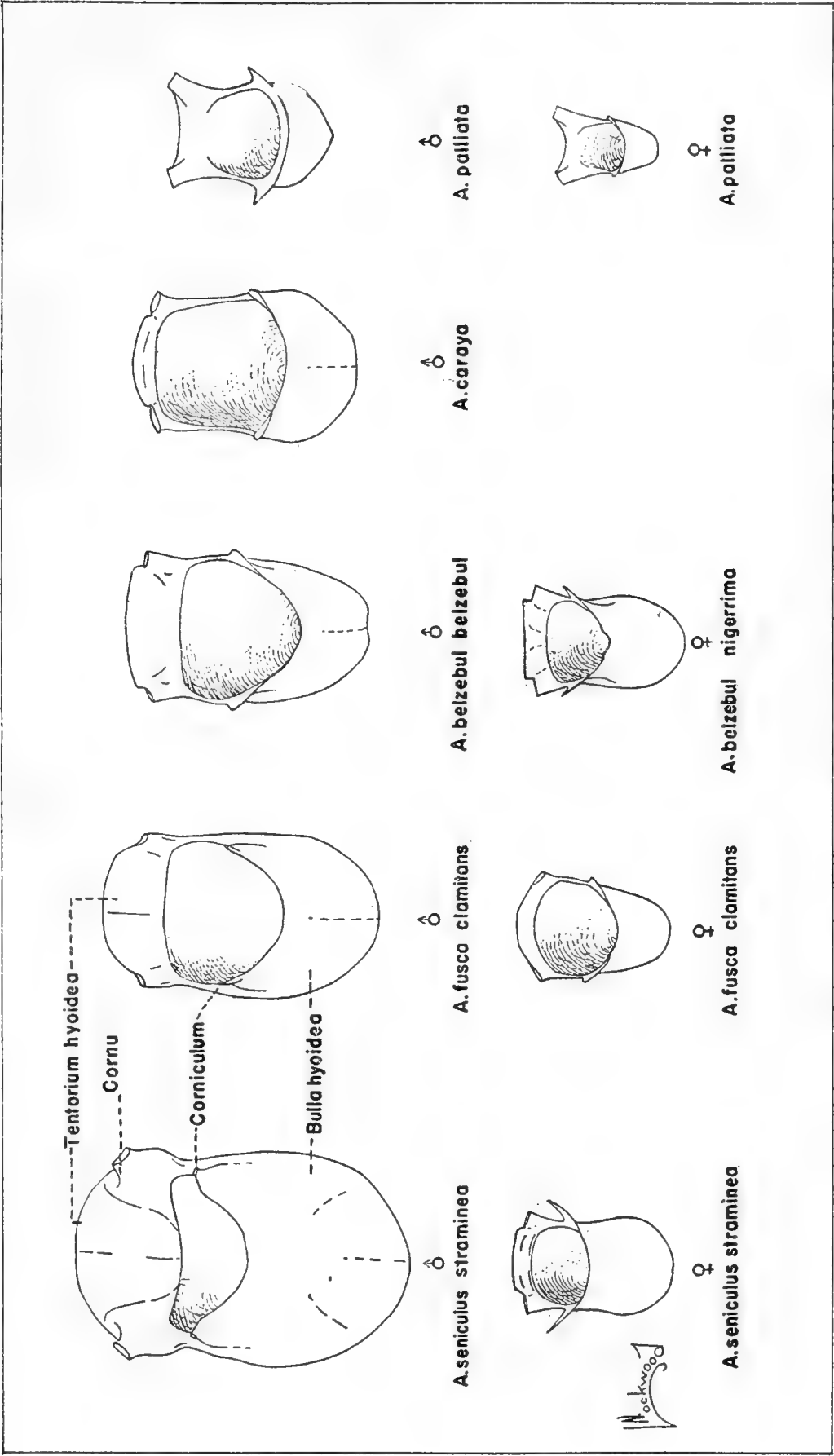


FIGURE 56.—Posterior aspects of hyoid bones of adult howlers, genus *Alouatta* ( $\frac{1}{2}$  natural size).

between mandibles, but apparently growth of hyoid in a dorsoventral direction is not seriously impeded and may continue indefinitely. Individual peculiarities of pitch, range, timber, and volume of voice of any one howler is reflected by corresponding peculiarities in structure of its hyoid. Most differentiated portions of hyoid of *seniculus* are tentorium, outline and diameters of opening or mouth, the area immediately bordering it, and internal wall of bulla. In males, outline of lamina of tentorium between articular depressions subcircular, oval, crescentic, rectangular, square, triangular, or trapezoidal; surface of lamina convex, plane, or slightly concave, sometimes bilobed; lower border of lamina plane, curved inward, or slightly outward; outline of edge of lamina even, scalloped, or with a slight median incision or projection; dorsal surface of tentorium rounded, flat or angular. Lateral borders of hyoid from articular depressions of tentorium to cornicules may be inflated or compressed, rounded, flat, or angular and with or without ridges and furrows; cornicules moderately developed or obsolete, their bases strongly inflated or slightly burled; inner surface of bulla crossed by numerous anastomosing ridges and trabeculae or traversed by only a short midventral line; inner lateral bony partitions of tentorium variable in development. It may be said, in short, that the male hyoid is a considerably more flexible structure than has been supposed and its development is influenced much more directly by exercise of muscles and chords attached to it than by the genetic constitution of the individual.

Female hyoids are much less specialized and correspondingly less variable in size and structure. Hyoid bones of very young individuals lack tentoria, and hyoids of half-grown males resemble those of adult females. Additional material may prove that characters of the female hyoid are much more reliable for determining real differences and relationships between species of howlers.

Hyoids of red howlers collected in various localities of northern Colombia vary in the same order individually and geographically. External and cranial variations of these same howlers also reveal no constant local differences.

#### ALOUATTA PALLIATA

#### PLATE 17, d; FIGURES 56, 57

*Description.*—Hyoid bone of adult male *A. palliata* is even smaller than that of female *A. seniculus*. Greatest width and depth of smallest and largest hyoid specimens at hand, both of fully adult males, are 22 by 33 and 27 by 38 mm., respectively. Entire posterior face of apparatus open with diameter of flaring mouth exceeding depth of shallow conelike bulla. Feature corresponding to tentorium in *seniculus* is here simply a broad extension or lamina, without infolding,

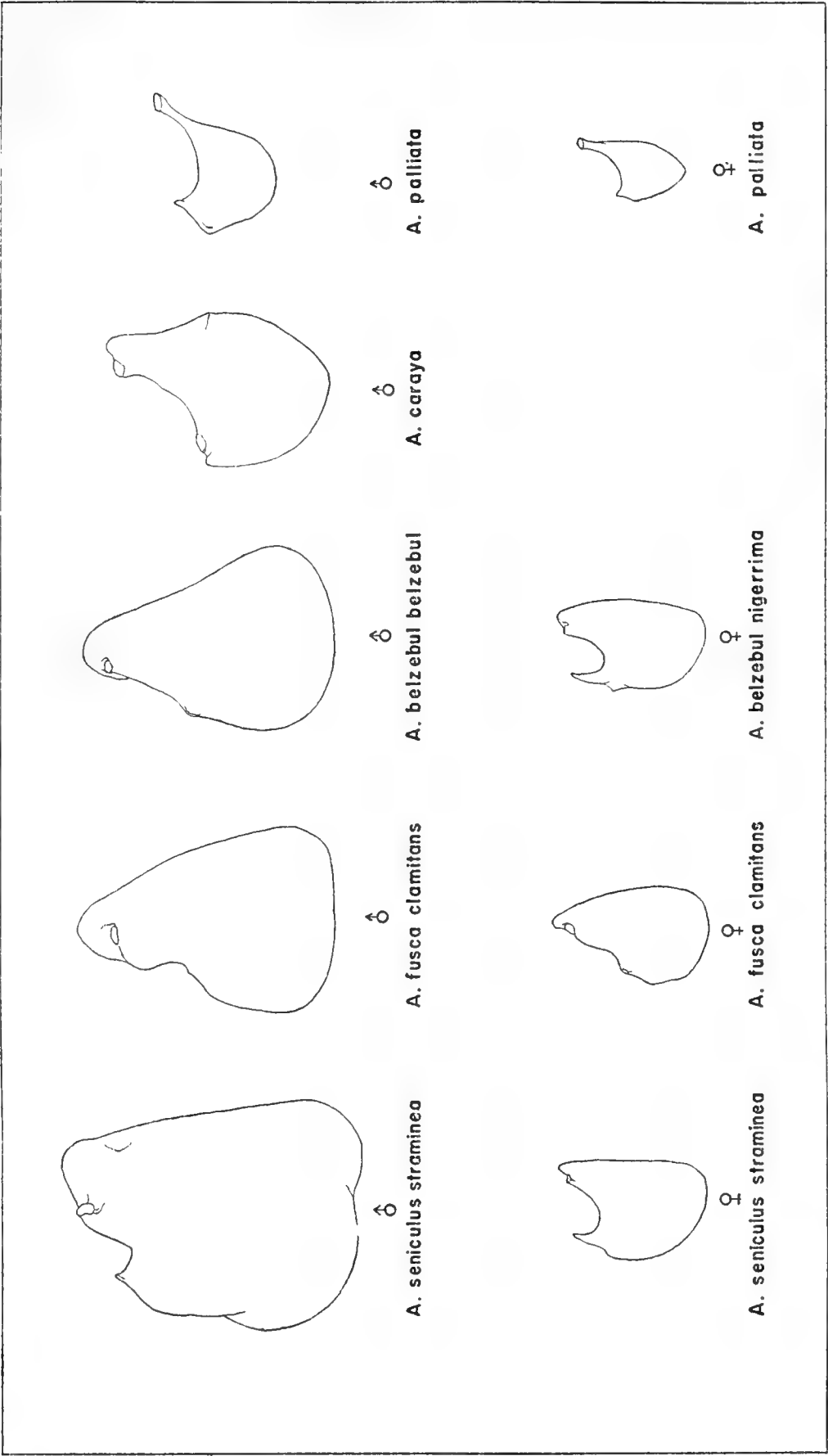


FIGURE 57.—Lateral profiles of hyoid bones of adult howlers, genus *Alouatta* ( $\frac{1}{2}$  natural size)

of dorsal wall of hyoid bone. Each corner of tentorium projected into a broad cornu for connection with thyreohyal. Near each lower corner of opening a well-developed corniculum for attachment of stylohyoid ligament is present. Inner surface of bone smooth, unmarked by the ridges, or trabeculae characteristic of male hyoid of *seniculus*.

Resemblance between male and female hyoids of *A. palliata* is much greater than that between hyoids of the two sexes of *A. seniculus*. Nevertheless, in both species relationship between sexes in size of hyoid bones is about the same. Greatest width and depth of one female *palliata* hyoid, 14 by 27 mm.; simple tentorial plate less developed than in male hyoid, its superior margin concave; cornicules prominent but only slightly projecting, bulla more saclike, opening less flaring than in male hyoid.

#### OTHER SPECIES OF HOWLERS

##### FIGURES 56, 57

Hyoids of *A. belzebul* and *A. fusca* resemble that of *A. seniculus* but are less specialized. The figure of a male hyoid bone of *A. beniensis* Lönnberg (1941, pl. 3, figs. 6a-b), does not reveal important differences by which it can be distinguished from hyoids of the *seniculus* type. The described external and cranial characters of *beniensis* indicate that it may best be regarded as a subspecies of *A. fusca*. Similarly, *A. nigerrima* Lönnberg (*op. cit.*, p. 33), judged by external and cranial characters of two females from Lago do Baptista, east side of the lower Rio Madeira, appear to represent a wholly black race of *A. belzebul*. The hyoid bones of both females are available and show agreement in important characters with that of a male hyoid of *A. belzebul* from Ilha de Marajó. The hyoid bone of *A. caraya* differs considerably from those of the *seniculus* and *palliata* groups.

Characters of hyoid bones of the various species of howlers, based on available material, and figures and descriptions of hyoid bones supplied by Ihering and Lönnberg are summarized as follows:

#### 1. *A. seniculus* group.

##### a. *A. seniculus seniculus*.

*Male*: Hyoid large, tentorium inflated to form large chamber with bony lateral partitions; cornua absent, tentorium with well-marked articular depression for thyreohyal; cornicula reduced or obsolete; rounded mouth of bulla relatively small, constricted at rim; inner surface of bulla parted by at least a midventral line or bony ridge.

*Female*: As described in text, p. 394.

##### b. *A. seniculus straminea*.

*Male*: As in *seniculus* ("a" above) but short stalklike cornua with rounded articular surfaces present; mouth of bulla smaller, its transverse diameter greater than sagittal diameter.

*Female*: As in female *seniculus* but tentorium less inflated, cornicula well developed, long, projecting, and tapering to a point.

c. *A. belzebul belzebul*.

*Male:* As in male *seniculus* but mouth of bulla larger, sagittal diameter about half greatest depth of hyoid bone, tentorium less developed, without lateral partitions; rudimentary cornua present; inner surface of hyoid nearly entirely smooth.

d. *A. belzebul nigerrima*.

*Female:* As in female *straminea* but tentorium more inflated (as in female *seniculus*), cornua obsolete.

e. *A. fusca*.<sup>8</sup>

*Male:* As in male *belzebul* but rudimentary cornua absent, articular depressions for stylohyal as in *seniculus*.

*Female:* As in female *seniculus* but mouth of bulla larger, occupying about one-half or more posterior surface of drum; tentorium less modified than in *seniculus*, little inflated and hardly or not at all forming a distinct chamber.

2. *A. caraya*

*Male:* Smaller than in *A. seniculus* group; mouth of bulla large, occupying more than one-half posteroventral surface of hyoid; rudimentary tentorium an extended plate with dorsal edge slightly bent or folded posteriorly but not inflated and without lateral partitions; rudimentary cornua present; cornicula approximately as in *seniculus*; outer dorsal surface of bulla angular and arched; inner surface of bulla smooth.

3. *A. palliata*

As described in text, p. 396.

*Remarks.*—The most highly specialized hyoid apparatus is found in male *A. seniculus*. The female hyoid of *A. palliata* is least modified and may be nearest that of the ancestral type of howler. The male hyoid of *A. caraya* is intermediate. Here a rudimentary tentorium appears and from this type, the male hyoid of *A. belzebul* can be derived. The male hyoid of *A. fusca* is more specialized, its tentorium more inflated, and it shows a tendency to develop the trabeculae and partitions on inner surface of bulla noted in male hyoid of *A. seniculus*. Relationship between sexes in size of hyoid is about the same in all species and out of all proportions to sexual differences in external and cranial characters. Throughout, the female hyoid is less modified than that of the male. Greatest structural differences between the sexes are found in hyoids of *A. seniculus*, the least in those of *A. palliata*.

## GENUS AOTUS ILLIGER: NIGHT MONKEYS, OR MICOS DE NOCHE

Ten specimens of night monkeys were secured in northern Colombia. Five are from Norosí, department of Bolívar, three from the Sierra Negra, Sierra de Perijá, the remaining two from El Orinoco, Río Cesar. Each series differs markedly in many external and cranial characters from the other two. Abundant comparable material

<sup>8</sup> Subspecies of *fusca* include *beniensis* and *clamilans* (*A. fusca guariba* Ihering, preoccupied by *guariba* Humboldt, replaced by *clamilans* Cabrera, 1940 [antedates *iheringi* Lönnberg, 1941, also proposed as a substitute]).

available from intermediate localities and from surrounding areas proves, however, that these characters are simply variations of the individual or of its family unit and are not representative of the entire population of a given locality. Apart from individual differences, cranial variations correlated with growth, maturation and senescence of the individual, are most remarkable and defy all attempts to define them. Other than usual organic differences between sexes are not apparent.

As a rule, a family unit consisting of adult male and female and, ordinarily, two young, nest together in the hollow trunk of a large tree. Any greater number of individuals, including more than two sexually mature individuals, living in the same nest, is more likely to be the result of inbreeding than of a fortuitous association. This is indicated by the uniformity in most characters within such a "series." At the same time, the characters of such a "series" may be strikingly different from those of other night monkeys of the same locality.

The genus *Aotus* is monotypic. Humboldt (1812, p. 306, ed. 2) in describing *Simia trivirgata*, the first specific name proposed for the genus, remarked that it represented a new family of monkeys "que l'on pourroit désigner par le nom d'*Aotes*." The name refers to an alleged lack of external ears in night monkeys. Later on in the description, Humboldt repeated his observation that the monkey in question belonged to a new family, or perhaps to a "nouveau genre de quadrumanes, celui des *Aotes*." Consequently, a number of authors (Jardine, Palmer, Ribeiro, Strand, Simpson) have adopted *Aotes* as the generic name. However, Cabrera (1939, p. 6) rejected *Aotes* in favor of the more commonly cited *Aotus* Illiger on the ground that Humboldt used *Aotes* as a vernacular name. This interpretation is not tenable. The vernacular name for night monkeys used by Humboldt is *douroucoulis*, and the French vernacular of *Aotes* is rendered *aôtes*. It is this last form, not used by Humboldt, that is "quoted" by Cabrera in his argument against the validity of *Aotes* as a generic name. An identical misquotation is given by I. Geoffroy (Voyage, la *Venus*, p. 48, 1855), and this may have been a source of Cabrera's conclusions. The only basis for rejection of *Aotes* is Humboldt's own lack of uniformity and consistency in the use of this superspecific designation. *Aotes* was first proposed in 1809 (*vide* Sherborn, Ann. Mag. Nat. Hist., ser. 7, vol. 3, p. 428, 1899) as a family, then as either a family or perhaps a genus to contain *Simia trivirgata*. In 1811, Illiger established *Aotus* clearly and indisputably as the generic name for night monkeys typified by *Simia trivirgata* Humboldt. Humboldt then adopted Illiger's *Aotus* in 1812 (*op. cit.*, pp. 320, 358).



Each of the many names proposed for local forms of the genus has been based in part or in whole on the structure of the most variable parts of the skull and the equally variable pattern of head markings. Real or imaginary anomalies have also figured among "specific" characters of named forms. External ears in the first described *Simia trivirgata* were said to be nearly obsolete. The last described, *Aotus bidentatus* Lönnberg, is based on an anomalous individual with a single pair of upper incisors. The author has examined the type specimens of *Aotus* in the British Museum (*nigriceps*, *lanius*, *senex*, *gularis*, *miconax*, *microdon*, *boliviensis*) and those conserved in the Paris Museum (*lemurinus*, *oseryi*, *spixii*, and *Nocthora trivirgata* Cuvier, not Humboldt). No valid specific differences were noted between any of these. On the contrary, individual variation among these types is such that some of them differ less from each other than they do from their respective cotypes or topotypes. Characters devised by Tate for members of the "aversus division" (included: *lanius*, *griseimembra*, *pervigilis*, *zonalis*, *bipunctatus*, *lemurinus*) and for the "trivirgatus division" (included: *infulatus*, *nigripes* [*nomen nudum*], *senex*, *vociferans*, *oseryi*, *gularis*, *spixi* [*sic*], *miconax*, *nigriceps*) appear to have been derived from specimens selected at random and from type specimens preserved in the American Museum of Natural History. Type specimens in the British and Paris Museums do not yield to Tate's characterizations. At best, some of these types straddle both his divisions. Cranial characters described by various authors for distinguishing the "species," must be discounted in their entirety. Large series of comparable skulls demonstrate their unreliability. External variations among night monkeys include a gray and brown color phase with all stages of intermediacy; pelage short, soft and dense to long, coarse and lax; head markings vary individually to such an extent that no one pattern is found to be locally constant. More often than not head markings described from a dried skin are determined by the manner in which the skin was prepared and dried; length of pelage further defines the ultimate appearance of head markings in the dried skin.

There appear to be several well-marked geographic forms of the genotype and only species. *Aotus trivirgatus trivirgatus* Humboldt<sup>9</sup> is the name for the night monkey of the Orinoco and a greater part of the northern and upper Amazonian regions. *A. t. azarae* Humboldt (*miriquouina* Geoffroy antedated), a well-defined form, occurs in the Chaco of Paraguay, Brazil, Bolivia, and Argentina. *A. t. roberti* Dollman of the Serra da Chapada, Matto Grosso, Brazil, grades into *azarae*. The brownish *A. t. lemurinus* Geoffroy is the night monkey

<sup>9</sup> With synonyms *humboldtii* Illiger, *duruculi* Lesson, *infulatus* Olfers (antedates *infulatus* Kuhl), *felinus* Spix, *vociferans* Spix, *commersonii* Vigors and Horsfield, *oseryi* Geoffroy and Deville, *gularis* Dollman, *senex* Dollman, and *spizii* Pucheran, based on a menagerie specimen of unknown origin.

of the Colombian Andes, while *A. t. microdon* Dollman, *nigriceps* Dollman (*miconax* Thomas, a synonym), and *A. t. boliviensis* Elliot (*bidentatus* Lönnberg, a synonym) are parallel forms distributed along the Ecuadorian, Peruvian, and Bolivian Andes, respectively. In the following account only the night monkeys recorded from Central America and western Colombia are discussed in detail.

Vernacular names of night monkeys are derived from their external appearance or resemblance to other, better-known animals, from their special markings, and from their habits and cries. These are, of course, the principal basic origins of vernacular names for other animals as well. In many parts of Colombia, *Aotus*, in common with *Potos flavus* and *Caluromys laniger*, is known as *marta* or its variants, *martica* and *marteja*. The name *marta* was applied by Spanish colonizers to these species because of a casual resemblance between them and the European marten in size, arboreal habits, and texture and color of fur. In Colombia and Venezuela the indigenous name *cusicusi* is also used indiscriminately for *Aotus*, *Potos*, and *Caluromys* because of this same sort of similarity. The descriptive names *cari-rayado* and *cuatro ojos*, invented by the Spaniards, have no known equivalent in any native tongue. According to Humboldt the name *duruculí* (*douroucoulí* in French phonetic) is applied to *Aotus* by the Marabitanas Indians. This name, like *ei-a*, also used in the upper Rio Negro-Orinoco region, is derived from what is heard as the cry of the night monkey. In southern Brazil and in the Chaco, the Guaraní name *mirikiná* is commonly used. Throughout the range of the genus the most prevalent names for *Aotus* are the Spanish *mico* (or *mono*) *de noche*, the Portuguese *macaco de noite*, and the Quechua-Spanish combination, *tuta mono*, all meaning night monkey. A nearly related name of very little usage, though common in literature, is the Spanish *dormilón*, or sleepy-head.

#### AOTUS TRIVIRGATUS GRISEIMEMBRA Elliot

- P[ithecia] hirsuta*, SCHOTT (*nec* Spix) Exec. Doc., vol. 7, No. 9, 36th Congress, 2d session, appendix E, zoology, p. 214, 1861 (Río Sucio, near mouth at Río Atrato).
- Nyctipithecus felinus*, BANGS (*nec* Spix), Proc. New England Zool. Club, vol. 1, p. 102, 1900 (Santa Marta, Colombia).
- Aotoes* [*sic*] *lemurinus*, ALLEN (*nec* Geoffroy), Bull. Amer. Mus. Nat. Hist., vol. 20, p. 465, 1904 (part; Bonda; Valparaiso).
- Aotus griseimembra* ELLIOT, Bull. Amer. Mus. Nat. Hist., vol. 31, p. 33, 1912.—ALLEN, Bull. Amer. Mus. Nat. Hist., vol. 31, p. 95, 1912 (Cereté, Río Sinú, Bolívar); vol. 35, p. 235, 1916 (Colombia: Hacienda Cincinnati; Bonda; Valparaiso).
- Aotus zonalis* GOLDMAN, Smithsonian Misc. Coll., vol. 63, No. 5, p. 6, 1914 (type locality, Gatun, Canal Zone, Panamá).—ALLEN, Bull. Amer. Mus. Nat. Hist., vol. 35, p. 235, 1916 (Colombia: Río Sinú, Bolívar).—ANTHONY, Bull. Amer. Mus. Nat. Hist., vol. 35, p. 374, 1916 (Panamá: Boca de Cupe;

Tapalisa).—GOLDMAN, Smithsonian Misc. Coll., vol. 69, No. 5, p. 225, 1920 (Panamá: Gatun; Boca de Cupe; Cana; Tapalisa).—ALLEN and BARBOUR, Bull. Mus. Comp. Zool., vol. 65, p. 272, 1923 (Panamá: Río Jesusito).

- [?] *Nyctipithecus rupifex* SCLATER, Proc. Zool. Soc. London, 1872, p. 3, pl. 1 (type locality, San Juan del Norte, Nicaragua).—ALSTON, Biologia Centrali-Americana, p. 15, 1882 (description and comments on type specimen; type locality questioned).

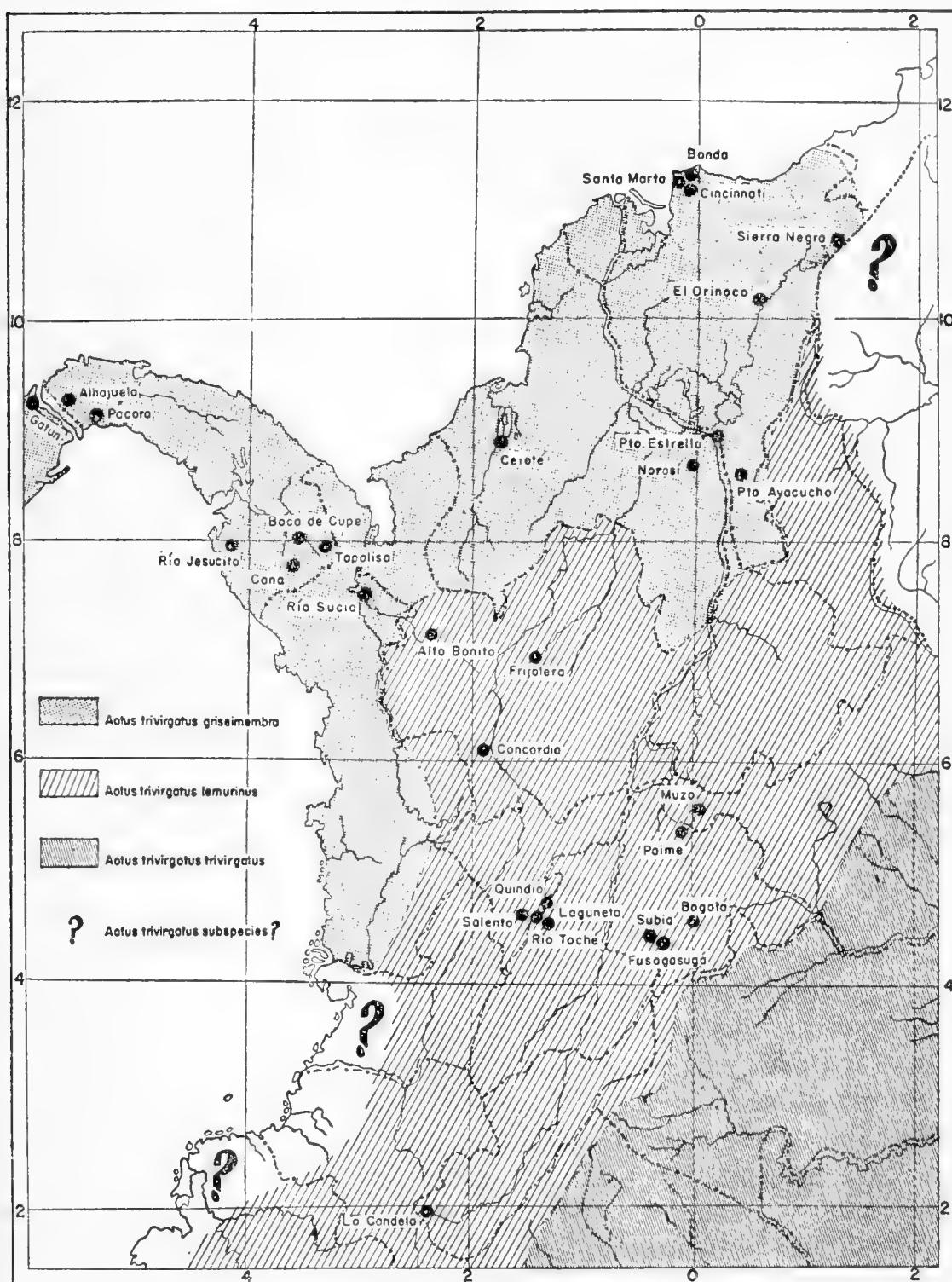


FIGURE 58.—Distribution of subspecies of *Aotus trivirgatus* found in Colombia and eastern Panamá. Collecting localities shown.

*Holotype*.—Adult male, skin and skull, A.M.N.H. No. 32664; collected July 20, 1911, by M. A. Carriker, Jr.

*Type locality*.—Hacienda Cincinnati (formerly known as Valparaiso), northeast of Santa Marta, on northwestern slope of the Sierra Nevada de Santa Marta, Magdalena, Colombia; altitude, 1,480 meters.

*Distribution* (map, fig. 58).—Canal Zone and eastern portion of Panamá; in Colombia, departments of Magdalena, Atlántico, Bolívar, northwestern Antioquia, and Chocó.

*Characters*.—As in *trivirgatus* but median dorsal band less sharply contrasted with sides of back; distinguished from *lemurinus*, by more uniformly paler coloration throughout, pelage shorter, the guard hairs and dark tipping of cover hairs of back reduced.

*Remarks*.—In general, night monkeys of the coastal plains are more warmly colored throughout than those of higher altitudes in the Serranía del Darién (Cana, approximately 600 meters), the Sierra Nevada de Santa Marta (Cincinnati, 1,400 meters) and the Sierra de Perijá (Sierra Negra, 1,300 meters). Apparently specimens from these montane localities have developed along parallel lines and become grayer, with pelage laxer. In no case is any of these populations sufficiently differentiated from its lowlands neighbors to warrant subspecific recognition for it. Specimens from Canal Zone, Panamá (*zonalis*), are in brown phase with upper surface of hands and feet blackish. These gradually grade into paler, grayer forms, in the upper Río Tuyra Basin, on one hand, but continue practically unchanged into the lowlands of the Atrato, Sinú, and Magdalena, on the other. In Colombian localities, however, upper surface of hands and feet are more commonly brown, less contrasted with forearms and forelegs. Night monkeys of the Río Cesar Valley are in gray phase like a toptype of *griseimembra* but with ischial region more brightly orange. Three specimens from Sierra Negra, Sierra de Perijá, also grayish, differ from the toptype by their laxer pelage, paler midventral region and browner terminal portions of tails.

Subspecific separation of northern Colombian and Panamanian *griseimembra* from typical *trivirgatus* is maintained pending examination of material from intermediate localities. Gray phase individuals of *griseimembra* from Canal Zone (Alajuela) and from the Río Cesar, Colombia, are almost identical with a near toptype of *trivirgatus* from Puerto Ayacucho, Río Orinoco. Similarly, brown-phase individuals from almost anywhere within the range of *griseimembra* can be matched with brown-phase toptypes of *trivirgatus*. The night monkey of the Azuero Peninsula, Panamá, described as *Aotus bipunctatus* is certainly a member of the common species but requires further comparison with additional material to determine its exact relation-

ship to *griseimembra*. Most characters of *bipunctatus* described as distinctive, appear to be, rather, individual variables.

The specimen described by Sclater as *Nyctipithecus rufipes* was received alive from San Juan del Norte, Nicaragua, by the Zoological Society of London. The original description and color plate indicate that the type most probably originated in Brazil and was transported as a pet to Nicaragua. The monkey cannot be identified with *griseimembra*. Its inclusion under this heading is for convenience of those interested in disposition of Central American records for the genus. So far, there is not one authenticated record of the occurrence of the genus in Central America outside of Panamá. Another specimen recorded by Sclater from "Costa Rica" is listed under *lemurinus* as it almost certainly originated in the highlands of Colombia.

*Specimens examined*.—Twenty-nine. COLOMBIA: Hacienda Cincinnati, 1 (A.M.N.H.); Santa Marta Mountains, 2 (M.C.Z.); Puerto Estrella, Río Magdalena, above El Banco, 1 (U.S.N.M.); Ayacucho, 25 kilometers east of La Gloria, Magdalena, 1 (U.S.N.M.); El Orinoco, Río Cesar, 2 (U.S.N.M.); Sierra Negra, Sierra de Perijá, 3 (U.S.N.M.); Norosí, Bolívar, 5 (U.S.N.M.); Cereté, Río Sinú, Bolívar, 2 (A.M.N.H.); Río Atrato, Chocó, 1 (U.S.N.M.). PANAMÁ: Gatun, 3, including the type of *zonalis* (U.S.N.M.); Río Indio, near Gatun, 1 (U.S.N.M.); Alajuela, Canal Zone 1 (U.S.N.M.); Pacora, 1 (U.S.N.M.); Boca de Cupe, 3 (U.S.N.M.); Cana, 2 (U.S.N.M.).

#### AOTUS TRIVIRGATUS LEMURINUS I. Geoffroy

*Nyctipithecus lemurinus* I. GEOFFROY, Comptes Rendus Acad. Sci., Paris, vol. 16, p. 1151, 1843; Zoologie de la *Venus*, pp. 70, 115, 1855; Atlas de zoologie de la *Venus*, pl. 3, figs. 1-9, 1846.

*Nyctipithecus lemurinus* I. GEOFFROY, Arch. Mus. Hist. Nat., Paris, vol. 4, p. 24, pl. 2, 1844.—GRAY, Catalogue of monkeys, lemurs and fruit-eating bats in the collection of the British Museum, p. 58, 1870 (Santa Fé de Bogotá).—MARTÍNEZ, Ann. Soc. Española Hist. Nat., Madrid, vol. 2, p. 243, 1873 ("Bogotá").—SCLATER, Proc. Zool. Soc. London, 1872, p. 3 (Bogotá; Costa Rica).

*Aotus lemurinus*, ALLEN, Bull. Amer. Mus. Nat. Hist., vol. 35, p. 234, 1916 (Fusagasugá, type and topotype of *aversus* Elliot; *vociferans* Elliot, not of Spix = *lemurinus* Geoffroy).—ANTHONY, Amer. Mus. Nov., No. 54, p. 9, 1923 (Muzo, northwest of Bogotá).

*Aotoes* [sic] *lemurinus*, ALLEN, Bull. Amer. Mus. Nat. Hist., vol. 20, p. 465, 1904 (part; Santa Fé de Bogotá; upper Cauca Valley, altitude 6,000 feet).

*A[otus] lemurinus*, CABRERA, Trab. Mus. Cienc. Nat., Madrid, No. 11, p. 27, 1912 (Bogotá).

*Nyctipithecus vociferans*, SCLATER, (nec Spix), Proc. Zool. Soc. London, 1890, p. 98 (mountains of upper Magdalena Valley, Tolima).—ALSTON, Biologia Centrali-Americana, p. 14, 1882, part (authenticity of Costa Rican locality of *Nyctipithecus lemurinus* Sclater, 1872, doubtful).

*Aotus vociferans*, ELLIOT (nec Spix), A review of the Primates, vol. 2, p. 13, 1913 (part; *Nyctipithecus lemurinus* Geoffroy in synonymy).

- Nyctipithecus felinus* GRAY (part, *nec* Spix), List of the specimens in the collection of the British Museum, p. 14, 1843 (Santa Fé de Bogotá).
- Nyctipithecus Commersonii*, GRAY (*nec* Vigors and Horsfield), Ann. Mag. Nat. Hist., ser. 4, vol. 11, p. 468, 1873 (neighborhood of Concordia, Antioquia).
- Nyctipithecus villosus* GRAY, List of the osteological specimens in the collection of the British Museum, p. 6, 1847 (type locality, Santa Fé de Bogotá).
- Nyctipithecus hirsutus* GRAY, Catalogue of monkeys, lemurs and fruit-eating bats in the collection of the British Museum, p. 58, 1870 (*nomen nudum*, a *lapsus calami* for *villosus* Gray, placed in synonymy of *lemurinus* Geoffroy).
- Aotus lanius* DOLLMAN, Ann. Mag. Nat. Hist., ser. 8, vol. 4, p. 202, 1909 (type locality, mountains of Tolima, Colombia, altitude 6,000 feet).—ALLEN, Bull. Amer. Mus. Nat. Hist., vol. 31, p. 95, 1912 (Río Toché, Tolima); vol. 35, p. 235, 1916 (Río Toché; Salento; West Quindío Pass; near Cali; La Candela [type and paratypes of *pervigilis* Elliot]; La Frijolera; Alto Bonito).—THOMAS, Ann. Mag. Nat. Hist., ser. 9, vol. 20, 1927 (neighborhood of Bogotá).
- Aotus aversus* ELLIOT, Bull. Amer. Mus. Nat. Hist., vol. 32, p. 251, 1913 (type locality, Fusagasugá, Cundinamarca).
- Aotus pervigilis* ELLIOT, Bull. Amer. Mus. Nat. Hist., vol. 32, p. 252, 1913 (type locality, La Candela, Huila).

*Lectotype*.—Adult male (?), skin mounted, skull separate, M. N. H. N., type catalog No. 102a, accession catalog No. 486 (545); purchased in 1842 from Parzudaki. The original description is based on skins and skulls of males and females of various ages. The specimens were received from several sources and originated in different localities in the Colombian Andes. None was originally designated as type. The specimen listed by Rode (1938, p. 37, Cat. Type Spec.) as holotype should be designated lectotype, instead. The only other known specimen of the original series, a lectoparatype, is also listed by Rode, but as an allotype. Both specimens have been examined by the writer. The lectoparatype, according to information on the stand on which it is mounted, was also purchased from Parzudaki in 1842. The colored figure of *lemurinus* accompanying the secondary description (*op. cit.*, 1844, pl. 2) differs in important respects from the original description. The two heads of *lemurinus* figured in the Atlas de Zoologie (*op. cit. supra*, figs 1–2), are of two different animals and neither of them the same as that of the earlier figure. It is problematical which of the three figures, if any, was modeled after the specimen now designated as lectotype.

*Type locality*.—In the first description, an abstract (*supra cit.*), the type locality is given simply as "Nouvelle Grenade," with a statement that several specimens had been collected by Goudot. In the complete description (1844, *op. cit. supra*), Geoffroy declared that the type series originated in "Santa Fé de Bogotá." This locality must be interpreted in its broadest sense. The name not only applies to the town of Bogotá but was often used to designate the whole interior of the country. In this account Geoffroy quoted Goudot as follows, "Ce petit quadrumane habite les grands bois de la région tempérée du Quindío, dans la Nouvelle-Grenade, depuis 1,400 mètres,



et même bien plus haut." As *Aotus* does not occur in the Bogotá region proper, which is savanna, the type locality is here restricted to that of the Goudot specimens. This is the only authentic locality for specimens of the original series. Ample material from forests of the Quindío (Cordillera Central, department of Caldas) is available and more has been recorded in literature. Specimens from localities in the typical region (Quindío Pass, Laguneta, etc.) conform to the original description in every detail.

*Distribution*.—Forested parts of the Colombian Andes exclusive of the northern half of the Sierra de Perijá.

*Characters*.—Average darkest of the races; pelage extremely coarse, long and lax.

*Remarks*.—The "diagnostic" characters of *lemurinus* are premised on evidence that the majority of specimens from the interior of Colombia live at higher altitudes than those of the coast and show, consequently, longer, coarser, and laxer pelage. Beyond this no single character serves to unite individuals here held to represent *lemurinus* into an assemblage distinct from all others. Variation in color and character of pelage is so great among these night monkeys that two discreet family groups of the same locality are apt to differ more from each other than either of them from a series of any other locality in the Colombian Andes. Specimens from the typical region in the Río Cauca drainage of the Cordillera Central include individuals inseparable from others throughout the range of the genus. The partial synonymy of *lemurinus* given above reflects the variability of the race.

*Aotus lanius* Dollman was described as "a mountain form allied to *Aotus trivirgatus*." Neither comparison with nor reference to *lemurinus* Geoffroy was made. The type is the same specimen previously identified by Sclater (*op. cit.*, 1890) as *vociferans*. A specimen from the Río Toché, a stream descending from the southern flank of Mount Tolima and draining into the Magdalena, may be regarded as strictly representative of *lanius*. It is richly brown in color and almost indistinguishable from a brown phase individual of *lemurinus* from the typical Quindío region across the divide in the Río Cauca drainage. As in the preceding, descriptions of *aversus* and *pervigilis* by Elliot include no reference to *lemurinus* and, it may be added, the vague *villosus* Gray, 1847, from the same general region. Topotypes of *aversus*, from Fusagasugá in the Magdalena Valley, southwest of Bogotá, are in pale brown phase with a well-defined blackish median dorsal band. This last character is not so uniformly clear in any of the available series from the Cordillera Central. These topotypes differ even more widely from the typical series of *aversus* and serve to emphasize the lack of consistency in characters of this or any other group of night monkeys described from Colombia. No two series



from other localities in the same general region as Fusagasugá show anything in common with topotypes of *aversus*. Two specimens from Subia, west of Fusagasugá, are in dark gray color phase with pelage longer and laxer than in any other specimens seen. Dark guard hairs of dorsal surface are extremely developed in these specimens. Of three specimens from Paime, two are dark gray, one pale brown. Pelage of these individuals is shorter and finer than in others mentioned, and they could just as well be included with *griseimembra* as with *lemurinus*. Two specimens from Muzo, lower down the Magdalena Valley, are more richly brown on dorsal surface, their pelage fine; only geographical considerations incline one to assign them to *lemurinus* rather than to *griseimembra*. On the other hand, two topotypes of *pervigilis* Elliot, from the head of the Magdalena Valley, at the southern extreme of the range, are similarly brown in color but with pelage long, lax, and coarse. Three specimens from Alto Bonito, Río Sucio, Antioquia, at the opposite extreme of the range, are like topotypes of *pervigilis* except for darker upper surface of hands and feet and more sharply defined head markings.

The *Nyctipithecus lemurinus* recorded by Sclater (*op. cit.*) was said to have been collected in Costa Rica by van Patten. The monkey was described as agreeing "in every respect with the skin of the same animal from Bogota." Alston (*op. cit.*) examined the specimen and questioned the authenticity of its origin in Costa Rica, a country outside the known range of the genus. Alston added that indicated localities of other material collected by van Patten "have not always been free of doubt." As both cited authors agree that the monkey in question is identifiable with the night monkey of the Colombian highlands, the Costa Rican locality may be disregarded and the specimen referred to *lemurinus*.

*Specimens examined.*—Forty. Salento, Caldas, 1,895 meters, 11 (A.M.N.H., 6; U.S.N.M., 5); Laguneta, Quindío Trail, Caldas, 2 (U.S.N.M.); West Quindío, Caldas, 9,000 feet, 2 (A.M.N.H.); Quindío Pass, southwest of Mount Tolima, 1 (U.S.N.M.); Río Toché, Tolima, 1 (A.M.N.H.); Fusagasugá, Cundinamarca, 1,746 meters, 7 (A.M.N.H., 1; U.S.N.M., 6); Subia, Cundinamarca, 2 (A.M.N.H.); Paime, Río Minero, Cundinamarca, 1,038 meters, 4 (U.S.N.M.); Muzo, Río Minero, Boyacá, 2 (U.S.N.M.); La Candela, Huila, 6,500 feet, 2 (A.M.N.H.); Río Chili, Manizales, Caldas, 1 (U.S.N.M.); La Frijolera, Río Cauca, Antioquia, 5,000 feet, 2 (A.M.N.H.); Alto Bonito, Río Sucio, Antioquia, 1,500 feet, 3 (A.M.N.H.).

#### Family CALLITHRICHIDAE: Marmosets

The three species of Colombian marmosets found west of the Cordillera Oriental are confined to the northwestern part of the country. All are included in genus *Marikina*. So far as known, each species

occupies an exclusive range. *Marikina geoffroyi* occurs in the Choco and eastern Panamá, *M. oedipus* between the Río Atrato and the Río Cauca-Magdalena, and *M. leucopus* between the Ríos Cauca and Magdalena. Twenty-seven specimens of *M. leucopus* were taken by the author. Good series of the first two species mentioned were secured by Carriker in 1916 and 1918 and made available to the writer through the kindness of J. K. Doult, of the Carnegie Museum.

#### ON THE CLASSIFICATION OF MARMOSETS

It is generally agreed that marmosets (exclusive of *Callimico* (if it is to be considered a marmoset)) are divisible into two principal groups. One group, characterized by incisiform lower canines, includes *Callithrix* (*Mico*) and *Cebuella*; the second group, with normal lower canine-incisor relationship, includes the remaining genera of Callithrichidae. There are several modern publications on the subject of characters and relationships of categories comprising the second group. Earliest of these is by Cabrera (1917b, pp. 31-32). After a brief and pithy critique of the nomenclature, he arranged a key under the generic heading of *Leontocebus* Wagner, translated as follows:

a. Upper lip without white mustache.

b. Pelage of head forming a long mane which nearly completely hides the ears.....subgenus **Leontocebus** s. s.

(Type by selection: *L. chrysomelas*)

b'. Pelage of head long but not forming a mane, the ears exposed.

subgenus **Tamarin** Gray

(Monotypic type: *L. ursulus*)

a'. Upper lip covered with white hairs forming a mustache.

subgenus **Mystax** Gray

(Type by tautonymy: *L. mystax*)

Bare-faced marmosets (*bicolor*, *oedipus*, etc.) were not discussed by Cabrera. In the same year, Pocock (1917, pp. 247-258), examined existing classifications of marmosets and described external characters of the principal groups. He recognized four genera of marmosets. After separating the dentally different *Hapale* (= *Callithrix*), Pocock distinguished *Leontocebus* from the two remaining genera by its elongated hand with webbing between the three middle fingers. *Oedipomidas* was separated from *Mystax* by the form of its ear, with lower posterior border of pinna emarginate or obsolete. *Seniocebus* was included in the synonymy of *Mystax*. In a later publication, Pocock (1920, pp. 91-113) repeated his observations on external characters of marmosets and compared them with those of Cebidae. He noted that the interdigital webbing in *Leontocebus* was also present, but to a lesser degree, in an individual of his genus *Mystax*. Thomas (1922, pp. 197-199) enlarged Pocock's classification by admitting the

bare-faced *Seniocebus* as a genus. His key to the genera *Leontocebus*, *Mystax*, *Seniocebus*, and *Oedipomidas* was based on length of fingers, size of ears, and color of tail and limbs. A list of the "species" of each genus was given. Tate (1939, pp. 207-209) discussed the nomenclature and replaced the preoccupied generic name *Mystax* with *Tamarin*. He combined *Seniocebus* with *Oedipomidas* as a subgenus of *Tamarin*. *Leontocebus* was retained as a full genus. Cruz Lima (1945, pp. 203-253) made use of the earlier name *Marikina* Lesson for the bare-faced marmosets heretofore included in *Oedipomidas* and *Seniocebus*. He also recognized the genera *Tamarin* and *Leontocebus*. No species were listed under the latter genus, but all Amazonian marmosets referable to *Tamarin* and *Marikina* were keyed and described, many of them figured in color.

It is apparent that subdivisions of marmosets with normal lower canine-incisor relationship include four recognizable species groups. At times these groups have been combined into one genus; at others, separated into genera. *Leontocebus* (s. s.), the least known and poorest represented in collections, has been most generally separated from the others. Its larger size and distinctive external and cranial characters justify its generic distinction. *Seniocebus* (= *Marikina* s. s.) has been combined at times with *Oedipomidas*; at others, with *Tamarin*. As long as diagnostic characters of each of these three categories are not found to be weightier, it is best to treat each as a subgenus of *Marikina*, the oldest available name. No consistent cranial characters distinguish any one subgenus of *Marikina* from another. Externally the bare-faced, large-eared *M.* (*Marikina*) is annectant between the equally large eared *M.* (*Tamarin*) and the bare-faced but small-eared *M.* (*Oedipomidas*).

The following key may aid in distinguishing *Leontocebus* from *Marikina* and the subgenera of the latter from one another:

- I. Hand elongated, palm narrow, digits long; first phalanges of second and third fingers and third and fourth fingers closely united by webbing; length of longest finger (with claw) more than twice width of palm; head and sides of face completely covered, the long hairs forming a mane concealing ears; sphenoidal pits or vacuities large.....**Leontocebus** (p. 423)
- II. Hands normal; palm broad, digits not markedly elongated; first phalanges of middle digits usually free, webbing, if present, extremely narrow; length of longest finger (with claw) less than twice width of palm; sides of crown and sides of face completely covered with hair or nearly bare; ears entirely or partially exposed. Sphenoidal pits or vacuities obsolete or absent.....**Marikina** (genus)
  - A. Side of head from brow to ear, cheeks, and chin covered with black, brown or reddish hairs<sup>10</sup>; arms, at least to wrists, black, brown, or red; tail, at least for terminal three-fourths, uniformly black or dark brown, with or without a grayish or rufous overlay; ears large.
 

**Tamarin** (subgenus, p. 411)

<sup>10</sup> For the white tamarin, see arrangement of species in subgenus *Tamarin*.

B. Side of head from brow to ear naked or sparsely haired white or brown; lower part of cheek, chin and upper part of throat nearly bare or sparsely haired; arms, hands and feet, above, whitish to ochraceous, never black; tail bicolor or with tip or terminal half contrasting with basal third.

1. Forehead and crown in front of ears naked or covered with short whitish or brown hairs; ears large, lamina of lower posterior margin of pinna complete, rounded and well developed.---**Marikina** (*sensu stricto*, p. 418)
2. Forehead and crown adorned with a conspicuous median band or crest of long white hairs; ears small, lamina of lower posterior margin of pinna deeply emarginate or obsolete----- **Oedipomidas** (subgenus, p. 414)

Classification of marmosets treated here places the most specialized genus *Leontocebus* last. Hairy-faced tamarins, subgenus *Tamarin*, of the genus *Marikina*, are most generalized as well as most diversified and widely distributed. They are listed first. The bare-faced tamarins, *Oedipomidas* (subgenus) and *Marikina* (*sensu stricto*), are nearly related but divergent branches of the common tamarin stock.

## GENUS MARIKINA LESSON

(Synonymies under subgenera)

### Subgenus TAMARIN Gray: Hairy-faced Tamarins

*Tamarin* GRAY, Catalogue of monkeys, lemurs and fruit-eating bats in the collection of the British Museum, p. 68, 1870 (subgenus of *Midas*; genotype, *Midas ursulus*, monotypic composite, restricted to *Midas ursulus* Geoffroy [= *Cebus tamarin* Link] by Palmer, Index Gen. Mamm., p. 660, 1904).

*Cercopithecus* GRONOV, Zoophylacium Gronovianum, fasc. 1, p. 5, 1763 (genotype, *Simia midas* Linnaeus, designated by Elliot, Bull. Amer. Mus. Nat. Hist., vol. 30, p. 341, 1911; generic name eliminated from consideration by suspension of Rules of Zoological Nomenclature, cf. opinion 89).

*Midas* HUMBOLDT, Recueil d'observations de zoologie et d'anatomie comparée, p. 361, 1812 (genotype, *Simia midas* Linnaeus, now designated; generic name preoccupied by *Midas* Latreille, 1796, a genus of Diptera).

*Midas* GEOFFROY, Ann. Mus. Hist. Nat., Paris, vol. 19, p. 120, 1812 (genotype, *rufimanus* Geoffroy, a species not included in Humboldt's original list; generic name antedated by *Midas* Humboldt and preoccupied by *Midas* Latreille).

*Mystax* GRAY, Catalogue of monkeys, lemurs and fruit-eating bats in the collection of the British Museum, p. 66, 1870 (subgenus of *Midas*; genotype, *mystax* Spix; generic name preoccupied by *Mystax* Stephens, 1829, a genus of Trichoptera).

*Tamarinus* TROUESSART, Cat. Mamm., Suppl., p. 29, 1899 (genotype, *mystax* Spix, designated by Pocock, Ann. Mag. Nat. Hist., ser. 8, vol. 20, p. 256, 1917).

*Distribution*.—Forested tropical zones of the Guianas, southern Venezuela, and the Amazonian regions of Brazil, Colombia, Ecuador, Peru, and Bolivia.

*Included species*.—The following arrangement is derived from original descriptions and colored figures and from the writer's notes on most of the types and many topotypes of named forms. Juvenal and aberrant characters are not taken into account in the key

characters. Accurate measurements of external and cranial characters useful in distinguishing the species are not available for most types, hence omitted from the key. Adjectives used as specific names are placed in the feminine when combined with *Marikina*.

I. Without white mustache or circumlabial band.

A. Hands and feet black---**Marikina (Tamarin) tamarin** Link (based on the *Tamarin nègre* of Buffon and Daubenton, 1789, suppl. vol. 7, p. 116, fig. 32. Type locality, district of Pará, determined by Wallace, Proc. Zool. Soc. London, 1852, p. 109). Synonym: *Saguinus ursula* Hoffmannsegg (Pará). Subspecies: *Marikina tamarin umbrata* Thomas (Cametá, Rio Tocantins, Pará).

B. Hands and feet yellow to orange---**Marikina midas** Linnaeus (French Guiana). Synonyms: *Callithrix Lacepede* Fischer, *Midas rufimanus* Geoffroy (Ipoussin, French Guiana), *Leontocebus midas egans* Thomas (Obidos, Rio Amazonas, Brazil).

II. With white mustache or circumlabial band.

A. WHITE TAMARINS---**Marikina melanoleuca** Miranda Ribeiro<sup>11</sup> (Pará, Brazil). Synonym: *Leontocebus hololeucus* Pinto (Santo Antonio, Rio Eirú, upper Rio Juruá).

B. LONG-WHISKERED OR EMPEROR TAMARINS. White moustache extremely developed and extending to shoulders when laid back, tail dominantly rufous---**Marikina imperator imperator** Goeldi (Rio Acre and upper Rio Purús region, western Brazil); **Marikina imperator subgriseus** Lönnberg (Santo Antonio, Rio Eirú, upper Juruá, southwestern Amazonas, Brazil).

C. BLACK-MANTLED TAMARINS. Terminal halves of hairs from nape to shoulders and of upper arms, blackish with or without fine buffy ticking.

1. Outer sides of hind limbs, except feet, not markedly different from middle of back.

a. Crown not entirely red.

(1). With a well-developed rufous or whitish patch on black crown; upperparts of body blackish with thighs and posterior part of back marbled; underparts sharply defined rufous---**Marikina labiata** Humboldt, Brazil (*Midas labiatus* E. Geoffroy, antedated). Synonyms: *Jacchus rufiventer* Gray ("Mexico"=*Midas rufoventer* [sic] Gray, Proc. Zool. Soc. London, 1865, p. 735, Brazil), *Midas elegantulus* Slack (Amazonian region), *Midas erythrogaster* Reichenbach (= *Hapale erythrogaster* Pelzeln, *nomen nudum*, Lago do Joanacan, Rio Solimões), *Midas thomasi* Goeldi (Tonantins, Solimões, western Brazil), *Midas griseovertex* Goeldi (Upper Purús and Acre regions, western Brazil).

(2). Without contrasting patch of white or rufous on black crown.

(a). Back marbled black and rufous, inguinal and anal regions not surrounded by wholly white hairs; basal halves of hairs of nape, upper arms and lateral fringe sharply defined whitish; white narial patches meeting at midline above nostrils---**Marikina mystax** Spix (between the Solimões and Içá, western Brazil).

(b). Back marbled black and gray or buff; inguinal and anal regions

<sup>11</sup> Cotype from Pará examined by Thomas (Ann. Mag. Nat. Hist., ser. 9, vol. 6, p. 269, 1920) and determined as a true tamarin (*ibid.*, vol. 9, p. 199, 1922). Four topotypes of *hololeuca* in the collection of the Chicago Natural History Museum are true tamarins and agree with the description of *melanoleuca*. Cruz Lima (1945) regarded both as conspecific but referred them to *Callithrix*.

with wholly white hairs; pale basal portions of hairs of nape, upper arms and lateral fringe not sharply defined from terminal portions; white narial patches meeting at midline above nostrils. **Marikina pluto** Lönnberg (Ayapúa, Río Purús, western Brazil).

(c). Back evenly ticked golden and black; basal portions of hairs of nape, etc., brown; white narial patches not meeting at midline above nostrils---**Marikina graellsii** Jiménez de la Espada (Destacamento, Río Napo, near confluence with Marañón, Loreto, Peru).

b. Crown and forehead sharply defined red---**Marikina pileata pileata** Geoffroy (near Pebas, Loreto, Peru); **Marikina pileata juruana** Ihering (middle Río Juruá, southwestern Amazonas, Brazil).

2. Outer sides of hind limbs, except feet, rufous, tawny, or red, in marked contrast with black or marbled midportion of back; tail black, feet dark.

a. Terminal halves of hairs of forehead and crown between ears broadly banded buffy or rufous---**Marikina fuscicollis** Spix (São Paulo de Olivença, between Solimões and Içá, western Brazil). Synonyms: *Midas flavifrons* Geoffroy (Pebas, Loreto, Peru), *Hapale nigrifrons* Geoffroy (unknown locality), *Mystax nigrifrons pebilis* Thomas (Pebas, Loreto, Peru).

b. Terminal halves of hairs of upperpart of forehead and crown black.

(1). With broad whitish transverse frontal band sharply defined from dark superciliary region; posterior half of back marbled or striated black and buff to rufous---**Marikina weddelli** Deville (Apolobamba, Bolivia). Synonyms: *Leontocebus purillus* Thomas (Río Xapury, upper Río Purús, western Brazil). *Mystax imberbis* Lönnberg (Victoria, confluence of Ríos Madre de Dios and Beni, Bolivia).

(2). Without contrasting whitish band across black forehead.

(a). Basal portions of hairs of nape, shoulders and upper arms white. **Marikina mystax** Spix (between the Solimões and Içá, western Brazil).

(b). Basal portions of hairs of nape, shoulders, and upper arms black or dark brown---**Marikina nigricollis** Spix (north bank Río Solimões near São Paulo de Olivença, western Brazil). Synonyms: *Midas rufoniger* Geoffroy and Deville (Pebas, Loreto, Peru), *Hapale devilli* Geoffroy (Sacayacu, Loreto, Peru), *Midas leucogenys* Gray (Brazil), *Leontocebus pacator* Thomas (Río Pachitea, Peru), *Mystax devillei micans* Thomas (Yurac Yacu, San Martín, Peru).

D. RED-MANTLED TAMARINS. Terminal halves of hairs (except, sometimes, fine black tips) from nape to shoulders, and of outer sides of limbs except hands and feet, tawny or reddish in marked contrast with black crown, tail, and marbled middle portion of back---**Marikina illigeri** Pucheran (believed to be Colombia, here restricted to the Colombian bank of the Solimões). Synonyms: *Midas lagonotus* Jiménez de Espada (Destacamento, Río Napo near confluence with Marañón, Loreto, Peru), *Midas tripartitus* Milne Edwards (Río Napo, Ecuador), *Mystax bluntschlii* Matschie (Río Saimiri, affluent of the Marañón, Loreto, Peru), *Midas apiculatus* Thomas (Río Copataza, upper Pastaza, eastern Ecuador), *Leontocebus mounseyi* Thomas, (Río Pacaya, opposite Sapote, lower Ucayali, Peru).



Subgenus OEDIPOMIDAS Reichenbach: Titis, or Crested Bare-faced  
Tamarins

*Oedipomidas* REICHENBACH, Die vollständigste Naturgeschichte der Affen, p. 5, 1862 (new name for *Ædipus* Lesson, preoccupied; genotype, *Simia oedipus* Linnaeus, designation by Elliot, A review of the Primates, vol. 1, p. 213, 1913).

*Ædipus* Lesson, Species des mammifères, bimanés et quadrumanes suivi d'un mémoire sur les Oryctéropes, pp. 184, 197, 1840 (subgenus of *Midas*; generic name preoccupied by *Ædipus* Tschudi, a genus of Amphibia; genotype, *Ædipus titi*, a monotypic composite restricted by elimination to *Oedipomidas oedipus* [= *Simia oedipus* Linnaeus] by Reichenbach, 1862).

*Hapanelia* GRAY, Catalogue of monkeys, lemurs and fruit-eating bats in the collection of the British Museum, p. 65, 1870 (subgenus of *Ædipus*; genotype, *Ædipus Geoffroyi* by monotypy).

*Distribution* (map, fig. 59).—Eastern Panamá and coast of northern Colombia west of the Río Magdalena.

*Included species*.—The two species of subgenus *Oedipomidas* are arranged in the following key:

1. Head dress continued behind ears and over nape as a flowing white mane; greatest width across pinna (dry) 13–15 mm.

M. (*Oedipomidas*) *oedipus* (p. 414)

2. Head dress white in front, sharply contrasted reddish on back of head and nape; greatest width across pinna (dry) 14–18 mm.

M. (*Oedipomidas*) *geoffroyi* (p. 416)

MARIKINA OEDIPUS Linnaeus

*Simia Oedipus* LINNAEUS, Systema naturae, ed. 10, vol. 1, p. 28, 1758.

*Simia [Midas] Oedipus*, HUMBOLDT, Recueil d'observations de zoologie et d'anatomie comparée, pp. 8, 332, 337–340, 361, pl. 3, figs. 1–2, 1805–1812 (description; habits; anatomy of larynx; distribution: Cartagena; Turbaco; Darién; mouth of Río Sinú).

*Ædipus titi* LESSON, Species des mammifères, bimanés et quadrumanes suivi d'un mémoire sur les Oryctéropes, p. 197, 1840 (part; the *adulte* only; description; synonymy).

*Seniocebus meticulous* ELLIOT, Bull. Amer. Mus. Nat. Hist., vol. 31, p. 31, 1912 (type locality, Río San Jorge, Bolívar, Colombia); A review of the Primates, vol. 1, p. 188, frontispiece (colored plate), photographic pl. 22 (skull), 1913.

*C[allithrix] Sciurea [sic]*, SCHOTT (*nec* Linnaeus), Exec. Doc. vol. 7, No. 9, 36th Congress, 2d Session, Appendix E, Zool., p. 213, 1861 (Isthmus of Darién; tame individual secured from natives).

*Oedipomidas ædipus*, ELLIOT, A review of the Primates, vol. 1, p. 213, pl. 26, 1913; Bull. Amer. Mus. Nat. Hist., vol. 33, p. 644, 1914 (*meticulosus* Elliot in synonymy).—ALLEN, Bull. Amer. Mus. Nat. Hist., vol. 35, p. 228, 1916 (Río San Jorge).

*Oe[dipomidas] Oedipus*, REICHENBACH, Die vollständigste Naturgeschichte der Affen, p. 5, figs. 18–20, 1862 (synonymy, including *Æaipus titi* Lesson).

*Leontopithecus ædipus*, THOMAS, Proc. Zool. Soc. London, 1911, p. 127.

*Type*.—None preserved. Name based on description and colored plate of Edwards' "little lion-monkey" (see below).

*Type locality*.—"America." Linnaeus described *oedipus* as "*Cerco-*



*pithecus minimus mexicanus*” and cited Edwards, Aves, iv, p. 195, pl. 195, 1751, as sole basis. According to Edwards, the original specimen was said to have been brought from “La Vera Cruz in New Spain [=México].” The species does not occur naturally outside of Colombia. The true habitat of the species was first determined by Humboldt (*op. cit. supra*). The data given by Humboldt plus present material permit restriction of type locality to the lower Río Sinú, department of Bolívar, Colombia.

*Distribution*.—Northern Colombia, from Golfo de Darién, Antioquia, east to Río San Jorge, department of Bolívar, thence north between the coast and the west bank of the Río Magdalena as far as Cartagena and at least the southern portion of department of Atlántico. The species may also occur in the area between the Río San Jorge and the Cauca.

*Coloration*.—Front of face sparsely haired, gray superciliary band well defined; chin, sides of forehead, neck, and face bare except for a fine whitish line from posterior corner of eye to angle of jaw. White headress pointed in front, the long hairs flowing behind over nape to interscapular region. Back Fuscous to Drab grizzled with buffy or striated with buffy and Mars Orange; rump and outer surface of thigh like back or nearly uniformly Mars Orange or Burnt Sienna. Leg, arm, upper side of hand and foot and ventral surface of body white, yellow, or ochraceous. Proximal one-third to one-fourth of tail Mars Orange to Burnt Sienna, distally paler and mixed with dark brown or black, terminal one-half dark brown or black.

*Measurements*.—Those of three males from Jaraquiel, Río Sinú followed by those of a female skull from Río San Jorge: Head and body, 224, 226, 245; tail, 380, 380, 382; hind foot, 72, 73, 70; greatest length of skull, 49.4, 50.4, 51.5, 50.1; zygomatic breadth, 31.9, 30.9, 32.6, 34.0; distance across orbital rings, 26.2, 26.4, 26.8, 28.5; width of brain case, 26.0, 26.1, 26.8, 27.7; distance across auditory bullae from meatus, 23.7, 23.5, 24.4, 23.4; crown length of upper molar row, 9.6, 9.6, 9.3, 9.0; crown width of first upper molar, 3.2, 3.3, 3.1, 3.3 mm.

*Remarks*.—There is no evidence that the range of *Marikina oedipus* overlaps that of *M. leucopus* to the east and that of *M. geoffroyi* to the west. It can be stated categorically that *oedipus* does not naturally occur east of the Río Magdalena in the department of Magdalena. It is possible, however, that the range extends west as far as the Río Atrato but certainly not beyond. No marmosets were seen by the writer during his short stay in the Ciénaga de Guájaro region, between Barranquilla and Cartagena, but *M. oedipus* is well known by natives there and is said to be common. Humboldt recorded the *tití* from Cartagena and the canal de Mahates, both localities a short distance southwest of the Ciénaga de Guájaro.

The vernacular name for marmosets in Colombia and Panamá is *titi*. The vernacular name *pinche* for *M. oedipus* was adopted by Buffon from an account by La Condamine of an entirely different monkey found living in Maynas, northeastern Peru. *M. oedipus* was first described and figured by Edwards (A Natural History of Birds, part 4, p. 195, pl. 195, 1751) as "the little lion-monkey from La Vera Cruz in New Spain." The specimen was alive and in the possession of the Countess of Suffolk. Brisson (1756, p. 210) described under the name "le petit singe du Mexique" another individual of *M. oedipus* brought from Mexico by Père Bernard Cordelier. On the other hand, Brisson (*op. cit.*, p. 200) applied the name "le petit singe-lion" to a living specimen of *Leontocebus rosalia* sent from Brazil in 1754 and owned by Madame Pompadour.

*Specimens examined*.—Sixteen. Jaraquiel, Río Sinú, Bolívar, 6 (C.M.); San Jorge, Bolívar, 1 (A.M.N.H.); "Isthmus of Darién," Antioquia, 1 (U.S.N.M.); no locality, menagerie and pet-shop specimens, 8 (U.S.N.M.).

#### MARIKINA GEOFFROYI Pucheran

*Midas Ædipus* (varietas), Spix (*nec* Linnaeus), Simiarum et vespertilionum Brasiliensium, species novae, p. 30, pl. 23, 1823 ("habitat, ut opinor, in provincia Guiana").

*Hapale Geoffroyi* PUCHERAN, Rev. Mag. Zool., Paris, vol. 8, p. 336, 1845.

*Ædipus titi* LESSON, Species des mammifères, bimanés et quadrumanes suivi d'un mémoire sur les Oryctéropes, p. 199, 1840 (part; *jeune adulte* = *Midas Ædipus* var. Spix, the example described, not *Ædipus titi* Lesson = *Marikina ædipus* Linnaeus, by restriction).

*J[acchus] Spixii* REICHENBACH, Die vollständigste Naturgeschichte der Affen, p. 1, pl. 1, fig. 2, 1862 (based on *Midas Ædipus* var. Spix, the figure given being a modification of the original *ex* Spix).

*Oedipomidas salaquiensis* ELLIOT, Bull. Amer. Mus. Nat. Hist., vol. 31, p. 137, 1912 (type locality, Río Salaquí, Chocó, Colombia).

*Midas Geoffroyi*, GEOFFROY, Arch. Mus. Hist. Nat., Paris, vol. 5, p. 579, 1845 (description; Panamá).

*Midas geoffroyi*, SCLATER, Proc. Zool. Soc. London, 1871, p. 478, pl. 38 (Panamá; Colombia, near coast).—SCLATER, Proc. Zool. Soc. London, 1872, p. 8 (Panamá).—ALSTON, Biologia Centrali-Americana, Mammalia, p. 17, 1882 (Panamá: Colón; Chepo; Chiriquí [!]; Colombia).

*Oe[dipomidas] geoffroyi*, REICHENBACH, Die vollständigste Naturgeschichte der Affen, p. 5, 1862.

*Oedipomidas geoffroyi*, ELLIOT, A review of the Primates, vol. 1, p. 214, 1913; Bull. Amer. Mus. Nat. Hist., vol. 33, p. 644, 1914 (synonymy including *salaquiensis* Elliot).—ALLEN, Bull. Amer. Mus. Nat. Hist., vol. 35, p. 227, 1916 (Colombia: Río Salaquí, Chocó; Baudo, Chocó).

*Leontocebus geoffroyi*, ANTHONY, Bull. Amer. Mus. Nat. Hist., vol. 35, p. 374, 1916 (Boca de Cupe; Chepigana; Cituro; Maxon Ranch (Río Trinidad); Tacarcuna; Tapalisa).—GOLDMAN, Smithsonian Misc. Coll., vol. 69, p. 226, 1920 (Cana; Chepo; Río Indio, near Gatun).—ALLEN and BARBOUR, Bull. Mus. Comp. Zool., vol. 65, p. 273, 1923 (Panamá: Río Esnape; Río Jesusito).

*Oedipomidas spixi* [sic], CABRERA, Ciencia, Rev. hispano-americana cienc. puras

y aplic., México, vol. 1, p. 403, 1940 (substitute name for *Hapale geoffroyi* Pucheran, "preoccupied" by *Simia geoffroyi* Humboldt).

*Holotype*.—Female, skin mounted, skull separate, M. N. H. N. type catalog No. 112, accession catalog No. 621; the living specimen donated to the menagerie of the Jardin des Plantes, Paris, died August 25, 1845.

*Type locality*.—"Panama," here restricted to Canal Zone.

*Distribution*.—From the Chocó, Pacific coast of Colombia, north into Canal Zone, Panamá; altitudinal range, sea level to approximately 700 meters above in the Serranía del Darién.

*Coloration*.—Face sparsely haired but with a well-defined line of whitish hairs from posterior corner of eye to angle of jaw; grayish superciliary band moderately well defined; median frontal region with a triangular crest of coarse white hairs; sides of crown sparsely haired. Hairs of reddish mantle from back of head to interscapular region black basally, Orange-Rufous to Mahogany Red terminally. Back and sides marbled or irregularly striated with black and buffy to ochraceous or white, the hairs black basally, white or Light Buff to Ochraceous-Buff, subterminally, tips black; outer surface of thigh like back, inner side often like basal portion of tail; outer surface of leg with less black than thigh, foot whitish to yellow or ochraceous on upper surface. Upper surface of shoulder, arm and hand, inner surface of limbs, neck (except nape), throat, chest and belly, white to yellow, the chest and belly often streaked with ochraceous; hairs at angle between chin and throat directed forward. Proximal one-fifth to one-third of tail mixed or striated black and Orange-Rufous to Mahogany Red, terminal portion uniformly black.

*Measurements*.—Those of a male and female from Sautatá, Río Atrato, followed by those (cranial only) of a male from Río Salaquí, Chocó, both localities in Colombia: head and body, 245, 250; tail, 382, 370; hind foot, 73, 72; greatest length of skull, 52.5, 51.2, 54.0; zygomatic breadth, 36.3, 35.4, 36.2; distance across orbital rings, 29.5, 28.5, 29.5; width of brain case, 28.0, 28.4, 27.6; distance across auditory bullae from meatus, 25.7, 25.5, 25.9; crown length of upper molar row, 9.8, 10.4, 10.0; crown width of upper first molar, 3.7, 3.4, 3.7 mm.

*Remarks*.—*Marikina geoffroyi* is the only marmoset indigenous to North America. Biogeographically, however, the Panamanian part of the range enters into the composition of the "Chocó-Darién" subzone of continental South America. Besides Panamá, Elliot erroneously included Costa Rica, instead of Colombia, in the range of *geoffroyi*.

According to Cabrera's (*op. cit.*) interpretation of the Rules regarding homonyms, *Hapale geoffroyi* Pucheran is preoccupied by *Simia*

*geoffroyi* Humboldt, a *Callithrix*, simply because Humboldt's *geoffroyi* had been transferred to the genus *Hapale* Illiger by Kuhl (Beiträge Zool., Abth. 1, p. 47, 1820). As in the case of *Cebus leucocephalus* Gray (cf., p. 344), such application of the Rules regarding primary homonyms to secondarily created homonyms is rejected. Pending clarification by the International Commission on Zoological Nomenclature, a "secondary homonym" is recognized here as equivalent to a true homonym only for the time it remains in the genus that automatically fixes its status as such. *Hapale geoffroyi* Pucheran is patently no primary homonym of *Simia geoffroyi* Humboldt. That Pucheran erroneously assigned his *geoffroyi* to the invalidated genus *Hapale* does not alter the fact that his and Humboldt's *geoffroyi* are not and never were simultaneously congeneric and, therefore, are not and never were secondarily homonymous. Unfortunately, the abused concept, not a rule, "once a homonym always a homonym" is subject to such interpretation that all technical names can lose stability by any manipulation of scientific terminology. Thus, present Rules do not prevent an author from referring all species of Primates to one genus and renaming all "secondary homonyms" thus created.

*Marikina geoffroyi*, along with all other Colombian species of marmosets, is known locally by the name *titi*. Allen and Barbour observed that in Panamá *M. geoffroyi* is "called 'Tití' by Spanish speakers and 'Bichichí' by Indians." This last name is applied also to *Saimiri sciureus* by the Indians of Maipures, Río Orinoco (*vide* Humboldt, Recueil, p. 333, who spells the name in French phonetic, "*Bitschetschi*").

*Specimens examined*.—Thirty-one. PANAMÁ: La Chorrera, 1 (U.S.N.M.); Agua Blanca, Canal Zone, 1 (U.S.N.M.); Alajuela, Canal Zone, 3 (U.S.N.M.); Las Cascades, Canal Zone, 1 (U.S.N.M.); Río Indio, near Gatun, Canal Zone, 8 (U.S.N.M.); Cana, Panamá, 2 (U.S.N.M.); Chepo, Panamá, 1 (U.S.N.M.); no precise locality, 5 (M.N.H.N., type of *geoffroyi* Pucheran; U.S.N.M., 4). COLOMBIA: Sautatá, Río Atrato, Chocó, 7 (C.M.); Río Salaquí, Chocó, 1 (A.M.N.H.); Baudo, Chocó, 1 (A.M.N.H.).

#### Subgenus MARIKINA Lesson: True Bare-faced Tamarins

*Marikina* LESSON, Species des mammifères, bimanés et quadrumanes suivi d'un mémoire sur les Oryctéropes, p. 199, 1840 (listed under synonymy of *Ædipus titi* Lesson [= *Simia oedipus* Linnaeus, see under *Oedipomidas* above] in an erroneous combination with [*Midas*] *bicolor* Spix and the bibliographic references thereto; genotype, *Marikina bicolor*, Lesson [= *Midas bicolor* Spix].—CRUZ LIMA, Contr. Mus. Paraense Emilio Goeldi Hist. Nat., English ed., vol. 1, p. 203, 1945.

*Seniocebus* GRAY, Catalogue of monkeys, lemurs and fruit-eating bats in the collection of the British Museum, p. 68, 1870 (genotype, *Seniocebus bicolor* [= *Midas bicolor* Spix], by monotypy).

*Distribution* (map, fig. 59).—North bank of Rio Amazonas from

Obidos, Pará, Brazil, west perhaps to Pebas in Loreto, Peru; and in Colombia, between the Ríos Magdalena and Cauca in departments of Bolívar and Antioquia.

*Included species.*—The three species of the subgenus *Marikina* are arranged in the following key:

1. Chest white, sharply contrasted with orange or reddish of belly; greatest width across pinna (dry), approximately 23.5–24.5 mm.

**M. (*Marikina*) *bicolor* (p. 421)**

2. Chest yellow to reddish, not markedly different from belly.

- a. Tail sharply bicolor, dark brown above, orange beneath; chin naked or nearly so; hairs of throat directed backward, not forming a whorl; greatest width across pinna (dry), 21–24 mm.---**M. (*Marikina*) *martinsi* (p. 422)**

- b. Tail with upper side not markedly different from lower; chin well covered, the hairs extending from whorl of throat and directed forward; greatest width across pinna (dry), 19–24 mm.----**M. (*Marikina*) *leucopus* (p. 419)**

#### MARIKINA LEUCOPUS Günther

*Hapale leucopus* GÜNTHER, Proc. Zool. Soc. London, 1876, p. 743, pl. 72.

*Callithrix leucopus*, ELLIOT, A review of the Primates, vol. 1, p. 222, 1913 (description; measurements; selection of lectotype).

*Seniocebus pegasus* ELLIOT, Bull. Amer. Mus. Nat. Hist., vol. 32, p. 252, 1913 (type locality, Puerto Berrío, Río Magdalena, Antioquia, Colombia).

*Oedipomidas leucopus*, ELLIOT, Bull. Amer. Mus. Nat. Hist., vol. 33, p. 645, 1914 (synonymy including *pegasis* Elliot).—Allen, Bull. Amer. Mus. Nat. Hist., vol. 35, p. 228, 1916 (Puerto Berrío; Malena, west of Puerto Berrío; Puerto Valdivia, Río Cauca).

*Lectotype.*—Skin and skull, British Museum (Natural History) No. 75.6.3.1; collected by T. K. Salmon.

*Type locality.*—Near Medellín, Antioquia, Colombia.

*Distribution.*—In Colombia from confluence of Ríos Magdalena and Cauca, department of Bolívar, north into department of Antioquia; altitudinal range from near sea level to approximately 1,000 meters above. The species does not occur naturally east of the Río Magdalena and west of the Río Cauca.

*Coloration.*—Front of face from lips to eyes sparsely covered with minute whitish hairs, chin with ochraceous to brownish hairs, cheek with long silvery hairs; forehead and crown to front of ears well covered with short silvery hairs converging to form a fine median frontal line; back of head between ears and nape like back but with pale lining reduced or absent. Hairs of back and sides Fuscous, Hair Brown, or Drab with terminal portions often silvery, or yellowish to Ochraceous-Buff, forming a lining through which brownish basal portions are visible. Hairs of chest, belly, and inner side of limbs Drab basally, Orange-Rufous to Mahogany Red terminally; nearly uniformly Drab hairs of throat forming a whorl. Outer side of arm, hand, leg and foot above white to Ochraceous-Buff, a brownish patch on ankle and metatarsus; thigh on outer side grading from color of back to that of leg. Tail brownish thinly lined with silvery to ochraceous, penciled tip uniformly silvery to ochraceous.

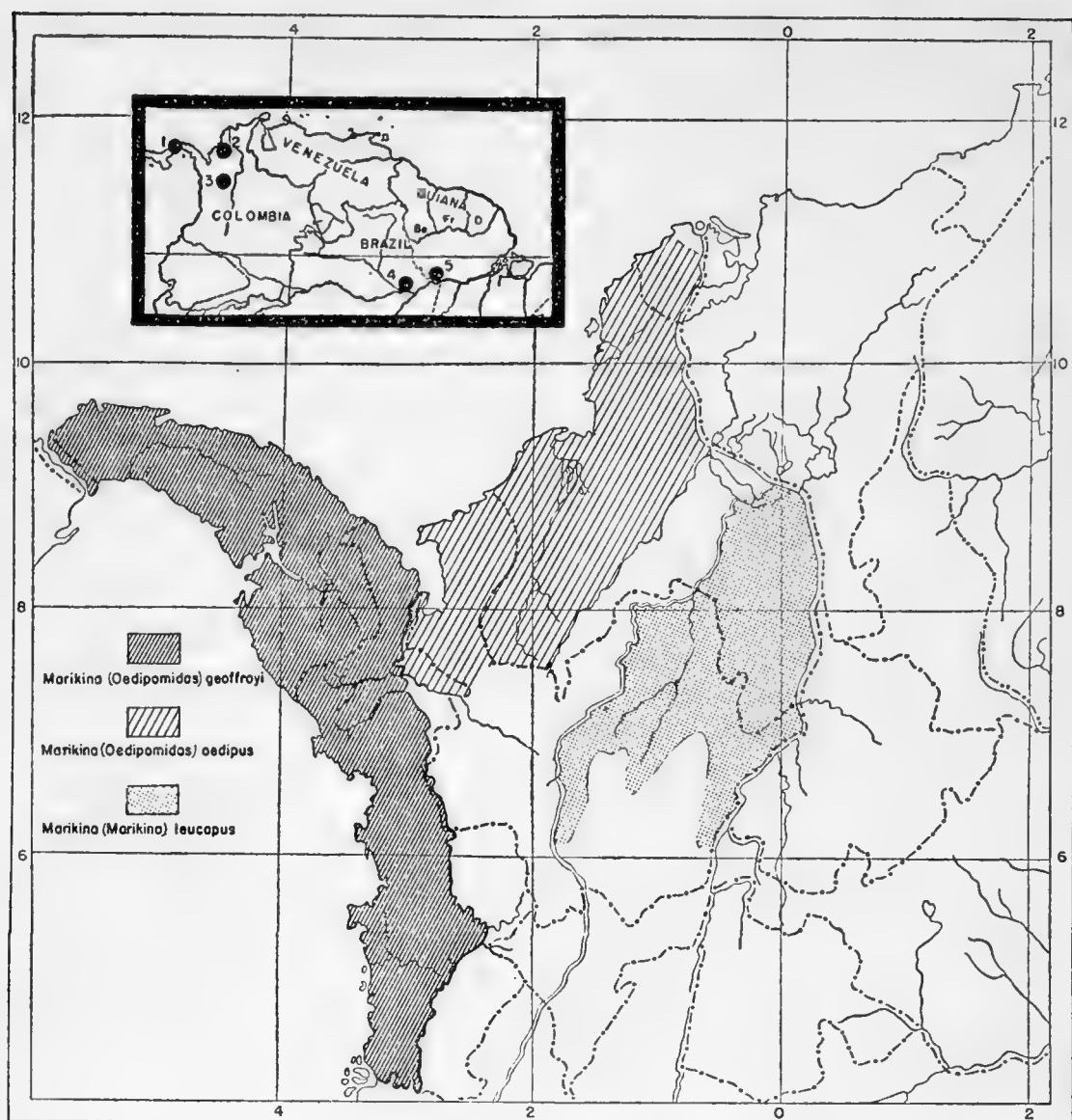


FIGURE 59.—Distribution of tamarins, genus *Marikina*, found in Colombia and Panamá. Inset, type localities of bare-faced tamarins: 1, *Marikina (Oedipomidas) geoffroyi*; 2, *Marikina (Oedipomidas) oedipus*; 3, *Marikina (Marikina) leucopus*; 4, *Marikina (Marikina) bicolor*; 5, *Marikina (Marikina) martinsi*.

*Measurements.*—Means and extremes of 25 adults (11 males and 14 females, all from Norosí, Bolívar): Head and body, 243 (224–283) tail, 383 (341–417); hind foot (with claw), 74 (66–80); ear (from notch), 27 (24–30); greatest length of skull, 50.6 (46.4–53.3); zygomatic breadth, 33.9 (31.6–36.0); across orbital rings, 27.7 (26.1–29.2); width of brain case, 27.9 (27.1–29.2); distance across auditory bullae from meatus, 22.7 (21.8–23.7); crown length of upper molar row, 9.7 (9.0–10.3); crown width of upper first molar, 3.3 (3.1–3.4) mm.

*Remarks.*—There are no apparent differences between sexes. Juvenals and adults show the same range of variation in color. Superficially, *leucopus* resembles *martinsi* in color of nape and back. The tail of *martinsi*, however, is sharply bicolor, limbs more ochraceous, ventral surface of body more yellow, less red. Skull of *leucopus* is



nearly brachycephalic, that of *martinsi* decidedly dolichocephalic. Altogether *leucopus* is smaller.

Three specimens of *leucopus* labeled as being from Puerto Estrella, right bank of Río Magdalena, and collected by H. M. Curran, must have been taken on the left bank of the river. The species does not naturally occur anywhere on the right bank of the Magdalena though it is abundant along the wooded edge of the left bank. M. A. Carriker, Jr. (*in epist.*), reports the occurrence of *leucopus* above Simití, Cordillera Central, altitude 3,200 feet. No other species of marmoset inhabits any part of the range of *M. leucopus*. There is an immense geographic hiatus between *leucopus* and its nearest relatives, *martinsi* and *bicolor*, both of the Amazonian region. Local name of *M. leucopus* is *titi*.

*Specimens examined*.—Thirty-four. Medellín, Antioquia, lectotype and cotype (B. M. N. H.); Puerto Valdivia, Antioquia, 1 (A.M.N.H.); Malena, west of Puerto Berrío, Antioquia, 1 (A.M.N.H.); Puerto Estrella, Río Magdalena, 3 (U.S.N.M.); Norosí, Bolívar, 20 (U.S.N.M.); Río San Pedro, Norosí, 7 (U.S.N.M.).

#### MARIKINA BICOLOR Spix

*Midas bicolor* SPIX, Simiarum et vespertilionum Brasiliensium, species novae, p. 30, pl. 24, fig. 1, 1823.—PELZELN, Verh. zool.-bot. Ges. Wien, vol. 33, 1883, p. 25, 1884 (Barra do Rio Negro).—GOELDI and HAGMANN, Bol. Mus. Goeldi (Paraense), vol. 4, p. 53, 1906 (Brazil).

*M[idas] bicolor*, GEOFFROY, Animaux nouveaux ou rares recueillis pendant l'expédition dans les parties centrales de l'Amérique du Sud, mammifères, p. 21, 1855 (Pebas, Loreto, Peru).

*Hapale bicolor*, WAGNER, Abh. math.-phys. Cl. bayer. Akad. Wiss. München, vol. 5, Abt. 2, p. 473, 1848 (Barra do Rio Negro).

*Ædipus titi* LESSON, Species des mammifères, bimanés et quadrumanes suivi d'un mémoire sur les Oryctéropes, p. 199, 1840 (part; *age non adulte* only, with "*Marikina*" *bicolor* Spix described as the example).

*Jacchus bicolor*, WALLACE, Proc. Zool. Soc. London, 1852, pp. 107, 109, 110 ("Guiana side of the Rio Negro near the city of Barra").

*Seniocebus bicolor*, GRAY, Catalogue of monkeys, lemurs, and fruit-eating bats in the collection of the British Museum, p. 68, 1870.—LÖNNBERG, Arkiv Zool., Stockholm, vol. 32, no. 10, p. 15, 1940 (Manáos; measurements).

*Tamarin (Oedipomidas) bicolor*, TATE, Bull. Amer. Mus. Nat. Hist., vol. 76, p. 208, 1939 (Manáos).

*Marikina bicolor*, CRUZ LIMA, Contr. Mus. Paraense Emilio Goeldi Hist. Nat., vol. 1, p. 205, pl. 33, fig. 1, 1945 (Flores, suburb of Manáos; description).

*Type*.—In Zoologische Staatssammlung, Munich.

*Type locality*.—"Wooded plains near the village of Rio Negro," (=Manáos), Amazonas, Brazil.

*Distribution*.—Known from vicinity of Manáos, east bank of Rio Negro, near its junction with the Amazon; also recorded by Geoffroy (*op. cit.*) from Pebas, north bank of the Amazon, below embouchure of Río Napo, Peru.



*Coloration*.—Chin to crown in front of ears nearly bare; back of head, nape, interscapular region with long white hairs, the white extending from shoulders over arms, throat, and chest and tapering to a point on anterior half of belly. Remainder of back and sides sharply contrasted Fuscous to Drab lined or grizzled with buffy to ochraceous, a poorly defined dark median band present or absent; outer surface of thigh and leg like back. Belly and inner surface of thigh Ochraceous-Orange to Orange-Rufous. Outer surface of fore limb white or yellowish, hand above silvery more or less lined with buffy or ochraceous. Tail above dark brown to black, penciled tip black, or like sharply defined orange underside of tail.

*Measurements*.—Of an adult female topotype: Head and body, 229; tail, 335, hind foot, 70; greatest length of skull 49.9; zygomatic breadth, 33.2; distance across orbital rings, 28.0; width of brain case, 27.4; distance across auditory bullae from meatus, 23.5; crown length of upper molar row, 9.6; crown width of first upper molar, 3.5 mm.

*Remarks*.—Tip of tail of an old female is black on upper side, that of the only other available specimen, an immature male, orange. The original color plate of *bicolor* shows the tail entirely orange except for paler basal portion and slightly darker tip.

*Specimens examined*.—Two. Manáos, 1 (C.N.H.M.); Campos Salles, Manáos, Rio Negro, Brazil, 1 (A.M.N.H.).

#### MARIKINA MARTINSI Thomas

*Leontocebus martinsi* THOMAS, Ann. Mag. Nat. Hist., ser. 8, vol. 9, p. 85, 1912.

*Seniocebus martinsi*, ELLIOT, A review of the Primates, vol. 1, p. 189, 1913 (description quoted).

*Oedipomidas martinsi*, ELLIOT, Bull. Amer. Mus. Nat. Hist., vol. 33, p. 645, 1914 (synonymy).

*Tamarin (Oedipomidas) martinsi*, TATE, Bull. Amer. Mus. Nat. Hist., vol. 76, p. 209, 1939 (Faro, Brazil).

*Marikina martinsi*, CRUZ LIMA, Contrib. Mus. Paraense Emilio Goeldi Hist. Nat., vol. 1, p. 205, pl. 33, fig. 2, 1945 (Faro; Rio Erepecurú, Pará, Brazil).

*Holotype*.—Adult male, skin and skull, British Museum (Natural History) No. 11. 12. 22. 2; collected April 27, 1911, by Oscar Martins; original number, 3.

*Type locality*.—Faro, north side of lower Amazonas, near mouth of Rio Yamundá, western Pará, Brazil.

*Distribution*.—Known only from the small area on north bank of lower Amazonas between Rios Yamandú (Faro), and Erepecurú (Obidos), state of Pará, Brazil.

*Coloration*.—Chin to crown in front of ears nearly bare; crown between ears sparsely covered with long Drab hairs. Nape, back, and sides Drab to Hair Brown lined with Light Buff to Ochraceous-Buff, brownish basal portions of hairs showing through, nape sometime without ochraceous lining. Fore limb Warm Buff to Antimony Yellow on outer side, more ochraceous on inner; outer side of hind

limb like side of back but more uniformly ochraceous, inner side Ochraceous-Orange; upper surface of hand and foot yellowish or ochraceous. Throat, chest, and belly Ochraceous-Buff to Ochraceous-Orange. Upper surface of tail dark brown, penciled tip and underside sharply defined Ochraceous-Buff to Ochraceous-Orange.

*Measurements*.—Those of one adult male and three adult female topotypes respectively: Head and body, 219, 240, 245, 250; tail, 349, 420, 400, 410; hind foot, 66, 74, 79, 83; greatest length of skull, 50.5, 52.0, 52.4, 54.1; zygomatic breadth, 35.9, 34.9, 35.1, 36.2; distance across orbital rings, 28.5, 28.3, 27.9, 29.0; width of brain case, 26.2, 27.3, 27.6, 27.1; distance across auditory bullae from meatus, 23.2, 23.3, 24.3, 25.5, crown length of upper molar row, 9.9, 10.3, 10.5, 10.2; crown width of first upper molar, 3.2, 3.5, 3.4, 3.3 mm.

*Specimens examined*.—Eight. Type (B.M.N.H.); Rio Yamundá, Faro, 1 (C.N.H.M.); Rio Piratucú, Faro, 5 (A.M.N.H.); Serra do Espelho, Faro, 1 (A.M.N.H.).

#### GENUS LEONTOCEBUS WAGNER: LITTLE LION-MONKEYS

*Leontocebus* WAGNER, Die Säugethiere in Abbildungen nach der Natur, Supplementband, vol. 1, Uebersicht pp. ix, v (*bis*), 1840 [1839] (subgenus of *Hapale*; genotype, *Midas leoninus* Geoffroy [= *Simia leonina* Humboldt preoccupied by *Simia leonina* Shaw, 1800, replaced by *Leontopithecus fuscus* Lesson = *Simia rosalia* Linnaeus], designated by Miller, U. S. Nat. Mus. Bull. 79, p. 380, 1912, antedates genotypic designation of *Hapale chrysomelas* Weid [= *Midas chrysomelas* Kuhl] by Elliot, A review of the Primates, vol. 1, p. 194, 1913).

*Leontopithecus* LESSON, Species des mammifères, bimanés et quadrumanes suivi d'un mémoire sur les Oryctéropes, p. 184, 1840 (subgenus of *Midas*; included species: *marikina* [= *Simia rosalia* Linnaeus], *fuscus* [= *Simia leonina* Humboldt, *nec* Shaw], *ater* [= *Jacchus chrysopygus* Mikan] *ater* var. A and *ater* var. B [= *Midas chrysomelas* Kuhl]; genotype, *Simia leonina* Humboldt, [= *Simia rosalia* Linnaeus] monotypic designation by first reviser Reichenbach, Die vollständigste Naturgeschichte der Affen, p. 6, 1862, antedates genotypic designation, *L. marikina* Lesson = *Simia rosalia* Linnaeus, by Pocock, 1917.

*Marikina* REICHENBACH (*nec* Lesson), Die vollständigste Naturgeschichte der Affen, p. 7, 1862 (included species: *rosalia*, *chrysomelas*, *albifrons*, *chrysopygus*; genotype, *Simia rosalia* Linnaeus, designated by Pocock, Ann. Mag. Nat. Hist., ser. 8, vol. 20, p. 255, 1917).

*Distribution*.—Eastern Brazil.

*Included species*.—The three species recognized are *Leontocebus rosalia* Linnaeus of coastal southeastern Brazil (Rio de Janeiro and São Paulo), *L. chrysomelas* Kuhl of coastal eastern Brazil (Bahia), and *L. chrysopygus* Mikan of São Paulo. In general, *L. rosalia* is a golden-yellow marmoset sometimes varied with white or black on face and head, and with black on back, hands, and feet. *L. chrysomelas* is black with maned portion of face, arms, and upper side of at least proximal half of tail golden. *L. chrysopygus* is black on upper parts

and mane, golden yellow on inner sides of hind limbs and superciliary region.

*Remarks.*—*Simia leonina* Humboldt was based on two individuals seen living in captivity in Popayán, Colombia. They were said to have been brought from Mocoa (river and town at head of Río Caquetá) and the Río Putumayo, at eastern base of the Cordillera Oriental, Colombia. The original description and colored plate (Humboldt, *op. cit.*, p. 15, pl. 5) indicate a marmoset whose identifiable characters correspond to those of *Leontocebus rosalia*. To this day there has been no confirmation of the natural occurrence of a member of the genus *Leontocebus* anywhere within the Amazonian region. Until the contrary can be demonstrated, it is fitting to dispose of *leonina* in the synonymy of *rosalia*. *Leontopithecus fuscus* Lesson is simply a new name proposed for *Simia leonina* Humboldt preoccupied by *Simia leonina* Shaw, 1800. *Simia albifrons* Thunberg (1819, p. 65, pls. 3, 4) had been considered by some authors a *Leontocebus*. Cabrera (1940, p. 403) deemed it unidentifiable and also showed the name to be preoccupied by *Simia albifrons* Humboldt, 1812.

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## BEES FROM CENTRAL AMERICA, PRINCIPALLY HONDURAS

By T. D. A. COCKERELL<sup>1</sup>

FROM October 1946 to April 1947 my wife and I were at the Escuela Agrícola Panamericana, in the Zamorano Valley of Honduras. This is a broad valley about 2,600 feet above sea level, separated from Tegucigalpa, the capital city, by a ridge having about 5,000 feet altitude, a spur of Uyaca Peak; on the upper part is the rain forest, about 6,000 to 6,600 feet, where the wild form of the avocado is found and Professor Williams once saw that beautiful bird the quetzal.

On the way toward the base of Uyaca Peak, perhaps a thousand feet above the Zamorano Valley, we came to Agua Amarilla, by some called Agua María.

We numbered all the species of bees collected, and the total ran up to 225. These may not all be distinct, but there must be at least 200. I have dealt with over 100 but do not feel able to work up the numerous species of *Halictus*, *Augochlora*, and other genera of small bees. These may have to await revisional work, taking into account the whole Central American fauna. I have been at a disadvantage because I supposed I should never again work on Neotropical bees and had parted with my whole Neotropical collection, partly to the U. S. National Museum and partly to the American Museum of Natural History. Also, since a recent illness, my eyes have not been as good as they were.

The bee fauna of Central America is far from uniform. We

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<sup>1</sup> The manuscript was assembled by K. V. Krombein, Division of Insect Identification, Bureau of Entomology and Plant Quarantine, after Professor Cockerell's death, from notes and descriptions that had been received from time to time and had been allowed to accumulate pending completion of the study.—C. F. W. MUESEBECK.

observed great differences due to altitude, and the accompanying difference in the flora. Thus on February 9 a group of collectors worked at over 5,000 feet on Mount Uyaca and got about 18 species not observed in the Zamorano Valley.

Cresson's catalog of 1879 lists 152 species of Central American bees, mostly from Mexico. But Friese (1916-1921) lists 243 species from Costa Rica, and of these only six are Cresson species. It is natural to suppose that Friese had more of the Cresson bees but failed to recognize them, but comparison of the descriptions does not suggest that this is the case, at least to any important extent. I am told that somewhere about the Nicaragua-Costa Rica border there is a marked change in the flora; but also I think most of the Friese species (he has 164 new) were obtained near sea level. The Honduras collection appears to include a considerable proportion of new species, with very little in common with the Costa Rican fauna but, as would be expected, more resemblances to that of Guatemala.

Prof. T. B. Mitchell kindly reported on my Honduras *Megachile*, and found eight species, of which two, those most numerous represented, appear to be new. These eight species are placed in seven subgenera, only one subgenus (*Chelostomoides*) containing more than one species.

The problem of subspecies or races in the Neotropical region is a complex one and can never be dealt with adequately until we have long series of specimens from many localities. In the Seitz volume on American Rhopalocera there are some very striking statements about Erycinidae and Morphidae, indicating that the local races are almost infinitely numerous. It is considered impracticable to describe and name all these races, but one who knows them well can tell where a particular butterfly came from.

Dr. J. Bequaert has very kindly identified the diplopterous wasps from Zamorano, and I give a list of species below. After receiving the first consignment (of 14 species) Bequaert remarked, "The wasp fauna is almost exactly that of the coastal lowlands of Honduras, where I collected (Puerta Castilla)." Thus the species of Diploptera appear to be more constant than those of bees, more widely distributed, and less affected by altitude.

#### WASPS OF ZAMORANO

*Polistes instabilis* de Saussure.

*Polistes carnifex* Fabricius.

*Polistes canadensis* Linnaeus.

*Polistes fuscatus neotropicus* J. Bequaert.

*Polistes major* Palisot de Beauvois.

*Polistes oculatus* Smith (new variety).

*Polybia simillima* Smith.

*Polybia occidentalis* Olivier.

*Polybia occidentalis spilonota* Cameron (also at Galeras). (This is a form with a 2-pronged pale spot on the mesonotum close to the scutellum; also all transitions to the typical race of the species, with entirely black mesonotum.)

*Brachygastra* (or *Nectarina*) *lecheguana* Latreille (also at Galeras).

*Synoecca surinama* Linnaeus.

*Synoecca surinama* var. *cyanea* Fabricius.

*Parachartergus apicalis* Fabricius.

*Stelopolybia areata* Say. A large nest in a tree.

*Stelopolybia pallipes myrmecophila* Ducke.

*Pachodynerus nasidens* Latreille.

*Stenodynerus otomitus* de Saussure (also at Galeras).

*Stenodynerus* sp., not known to Bequaert.

*Rygchium cordovae* de Saussure, at Agua Amarilla.

*Eumenes* (*Omicron*) *totonacus* de Saussure. Also at Agua Amarilla.

*Mischocyttarus immarginatus* Richards. At Agua Amarilla.

### Genus COLLETES Latreille

#### COLLETES PERPLEXUS Smith

HONDURAS: Zamorano, December (W. P. Cockerell); Uyaca Peak, March. Described from Orizaba, Mexico.

The thorax above has short, dense, bright ferruginous hair, and the abdomen has white hair bands.

### Genus PTILOGLOSSA Smith

#### PTILOGLOSSA HONDURASICA, new species

*Female*.—Length about 17 mm., anterior wing about 11, width of abdomen about 6; head and thorax black, abdomen shining olive-green; eyes not converging above; ocelli not enlarged; clypeus convex, shining, with coarse punctures and an indistinct median sulcus; scape shining black; flagellum obscurely brownish beneath; hairs of head grayish white; mesonotum and scutellum dullish, without evident sculpture, the scutellum with a median groove; area of metathorax shining; hair of thorax slightly pubescent (largely denuded) above, white on sides; tegulae testaceous; wings short, reddish hyaline; second submarginal cell narrow, pointed above; legs black, the tarsi reddish apically; hair of legs grayish, white on femora and venter, black anteriorly on the very broad hind basitarsi; first tergite with dense white hair at sides; third and fourth with fine white pubescence apically, the two apical tergites with dark gray hair; sides of venter with long white hair.

HONDURAS: Agua Amarilla, December 15.

*Type*.—U.S.N.M. No. 58431.

Allied to *P. mayarum* Cockerell, but that has the first tergite with abundant long fulvous hair, except at sides, where it is dense and creamy white, but on upper part of sides stained with sooty. The apical depressions of the tergites are grayish, with very fine white

hair, especially noticeable at sides, and there are no golden bands, such as are found in *P. mayarum* and its allies. The hair at the sides of the thorax is entirely whitish, not partly dark as in *P. mexicana* Cresson. The ocelli are close together and not particularly large.

**PTILOGLOSSA WILMATTAE, new species**

*Male*.—Very robust, length about 17 mm., anterior wing 15, width of abdomen 7.5; dark parts black, not metallic; eyes converging above, approaching on vertex; ocelli large; mandibles black; clypeus honey color, shining in middle, with a short longitudinal depression; face with much pale fulvous hair; dense at sides; scape pale fulvous in front, flagellum black; thorax black, densely covered with red hair, on dorsum hiding the surface; scutellum densely and finely rugoso-punctate; area of metathorax shining on disc, with a median groove; middle and hind legs black, but front tibiae and tarsi pale fulvous; inner spur of hind tibiae curved; wings reddish hyaline; second submarginal cell small and narrow, coming to a point above; first tergite with a very broad bare basin, but all around it the surface is densely covered with red hair; second tergite with a broad black exposed band, but apical region broadly ferruginous; third and fourth tergites ferruginous, essentially bare; apical part of abdomen, and venter, with dense long red hair.

HONDURAS: Zamorano, on *Ipomoea*, October 29 (W. P. Cockerell).

*Type*.—U.S.N.M. No. 58432.

This handsome species resembles *P. buchwaldi* Friese from Costa Rica, but that is regarded by Friese as a variety of *P. ducalis* Smith (*eximia* Smith), which is very different from the present insect. It does, however, resemble *P. ducalis* in the long marginal cell, which separates it from *P. mexicana* Cresson. *P. eximia* is from Mexico, and Schrottky had *P. ducalis* from Argentina and considered it a different species, contrary to the opinion of Friese.

**Genus PROSOPIS Fabricius**

**PROSOPIS ALBIFRONTILLA, new species**

*Male*.—Length about 7 mm.; black, with white face and other markings; face rather narrow, white up to antenna, and on supraclypeal area, and slender white bands running up sides of front; labrum white; antennae black, more or less pale beneath; tubercles and scutellum white; wings dusky, pale at base, dark at costapical region; legs marked with white, the hind tibiae more than half white; abdomen shining with very conspicuous and sharply defined apical hair bands on first two tergites.

HONDURAS: Zamorano, December 14 (W. P. Cockerell).

*Type*.—U.S.N.M. No. 58433.

By the white hair bands of abdomen this resembles *P. gualanica* Cockerell of Guatemala, but the white face and other characters are distinctive.

**PROSOPIS ZAMORANICA, new species**

*Male*.—Length about 4.5 mm.; black, with cream-colored markings; orbits converging below; face below level of antennae entirely cream color, the upper part of this broadly invaded by the antennal sockets, while narrow lateral face marks extend upward halfway up front; antennae long, the short scape light in front, the flagellum black, with a pale stripe on lower part; collar, tubercles and scutellum cream color; mesonotum entirely dull; area of metathorax shining, with strong plicae; tegulae dark, but shining; wings hyaline, slightly dusky, with no dark spots; legs mainly black, but hind tibiae broadly at base and basitarsi pale; abdomen slender and pointed, shining, without hair bands.

HONDURAS: Zamorano, January 22 (Adan Rivera).

*Type*.—U.S.N.M. No. 58434.

Related to such species as *P. gualanica* Cockerell and *P. maculata* Friese, which have a yellow scutellum, but differing in minor details.

**PROSOPIS RUFOCLYPEATA Friese**

HONDURAS: Zamorano, January (Rua Williams). Described from San José, Costa Rica. This very small bee is easily recognized by its red clypeus.

**Genus ANDRENA Fabricius**

**ANDRENA AMARILLA, new species**

*Female*.—Length about 11 mm.; black, with broad fulvous sutural bands at ends of first and second tergites, the first band partly on first tergite and partly at base of second, the second band on apical part of second tergite, and in middle about as wide as the black part before it; face rather narrow, the facial quadrangle much longer than wide; flagellum obscurely brownish beneath; clypeus shining, with distinct punctures, front and cheeks with long white hair; thorax above densely covered with long pale ferruginous hair; area of metathorax not ribbed; tegulae pale testaceous; wings yellowish, with very pale stigma and nervures; legs black, the tarsi reddish at end; hind basitarsi broad, with black hair on outer side; abdomen dullish, but the bands are shining; apex fulvous, but the hair surrounding the apex is white. This species appears to belong to the subgenus *Pterandrena*, and so is related to *A. discreta* Smith, from Oaxaca, Mexico, but that species has the abdomen ferruginous, with the base black.

HONDURAS: Agua Amarilla, December, four specimens. They had collected bright orange pollen, presumably from one of the Compositae.

*Type*.—U.S.N.M. No. 58435.

**ANDRENA VIDALESII, new species**

*Male*.—Length about 7 mm.; black, the clypeus (except two black spots) and lateral face marks (quadrate, filling space between clypeus and eyes with a very small extension upward along orbit) cream color; labrum and mandibles black; head large, face very broad, inner orbits shining; antennae black; thorax small, mesonotum shining, with scanty hair; tegulae dark; wings dusky, stigma large, dusky reddish; basal nervure interstitial; second submarginal cell smallest, parallel-sided, receiving first recurrent nervure some distance from end, and the second recurrent received by third submarginal about as far from its end; legs black; abdomen with narrow white hair bands on margins of second to fourth tergites.

HONDURAS: Zamorano, October (G. Vidales).

*Type*.—U.S.N.M. No. 58436.

This may be compared with *A. agilis* Smith, from Oaxaca, Mexico, but is distinguished by the lateral face marks, and the lack of long hairs on the thorax above.

**ANDRENA UYACENSIS, new species**

*Female*.—Length about 9.5 mm.; robust, black, the head and thorax above with ferruginous hair; malar space linear; process of labrum broad, polished; facial foveae broad but short, not separated from orbits; clypeus shining, duller at sides; head with dull white hair, noticeable on sides of face; flagellum obscurely brownish beneath; mesonotum and scutellum polished; area of metathorax shining, but posterior truncation dull; tegulae shining fulvous; wings not reddish, faintly dusky, more so in apical field; stigma small, nervures dark; second submarginal cell approximately square, receiving first recurrent nervure near end; third submarginal cell long; legs with the hind tibiae and base of their tarsi dull red; middle basitarsi large, broad, with black hair; abdomen dullish, margins of tergites very narrowly shining; second and third tergites covered at sides only with dull whitish hair; fourth tergite with an entire band of pale, slightly reddish hair, and entire apex densely clothed with the same.

HONDURAS: Uyaca Peak, over 5,000 feet, February 9.

*Type*.—U.S.N.M. No. 58437.

This does not have the reddened wings and pale red nervures of *A. amarilla* Cockerell.

**ANDRENA HONDURASICA, new species**

*Male*.—Length about 8.5 mm.; black, the head and thorax with long grayish-white hair; flagellum black, long and thick, reaching scutellum; clypeus produced, shining, with scattered punctures; mesonotum and metathorax dull, scutellum shining in front; wings clear, nervures dark brown; stigma narrow, marginal cell long, and apically narrowed; second submarginal cell small, parallel-sided,

higher than long, receiving first recurrent nervure at its apical corner; first submarginal cell long, a little longer than third; second recurrent nervure ending a short distance before end of third submarginal cell; legs black, slightly brownish apically, very slender, the hind legs especially long and slender; abdomen convex, shining, hind margins of tergites 2 to 4 with polished bands, not hairy, first tergite with a narrow band; depressed part of second tergite hardly a third of length of tergite; the bare abdominal bands have a yellowish, almost golden appearance, and there is a little white hair at extreme sides.

HONDURAS: Uyaca Peak, February 9.

*Type*.—U.S.N.M. No. 58438.

The following key may be of use in separating the Honduras species:

- |   |                                  |
|---|----------------------------------|
| Males.....                              | 1                                |
| Females.....                            | 2                                |
| 1. Face light yellow.....               | <i>vidalesi</i> , new species    |
| Face black.....                         | <i>hondurasica</i> , new species |
| 2. Wings red and nervures pale red..... | <i>amarilla</i> , new species    |
| Wings not red.....                      | <i>uyacensis</i> , new species   |

#### Genus PSEUDOPANURGUS Cockerell

##### PSEUDOPANURGUS RUFOSIGNATUS, new species

*Female*.—Length about 8 mm., anterior wing 6.2; black, robust, with dark fuliginous wings; head and thorax almost devoid of pubescence, abdomen with broad grayish-pubescent bands at bases of tergites 3 to 5, the apex densely pubescent and somewhat reddish, venter with thin dull white hair, not carrying pollen; hind tibiae and basitarsi with a large pale scopa, full of pollen; tip of antenna red; tongue long and slender, labial palpi not nearly as long as tongue; face and front dull, densely and coarsely punctured; thorax densely rugosopunctate, but a highly polished band just behind scutellum; axillae not produced, but metathorax angular at sides; tegulae black; basal nervure falling short of nervulus; stigma well developed; marginal cell broadly obtuse at end, with an appendiculation; second submarginal cell very large and long, receiving the first recurrent nervure very far from its base, the distance being about as great as the basal width of the cell, while the second recurrent is received a moderate distance from the end; abdomen with the apical depressions of the tergites broad and polished, first tergite closely punctured.

HONDURAS: 8 km. west of Dos Aguas, October 27 (Vidales).

*Type*.—U.S.N.M. No. 58439.

A peculiar species, perhaps referable to a new genus.

#### Genus HETEROSARUS Robertson

##### HETEROSARUS AUREIFRONS, new species

*Male*.—Length about 6 mm.; slender, black, the face up to level of antennae shining orange-yellow; the labrum, base of mandibles, and



a stripe on scape yellow; antennae obscurely brown beneath; no light markings on thorax or abdomen; femora shining black, but knees, tibiae, and tarsi light yellow; tegulae black; wings hyaline, stigma large, pale brown, marginal cell truncate at end; first recurrent nervure joining second submarginal cell far from base; abdomen long and narrow, shining, traces of white hair bands at sides.

HONDURAS: Zamorano, November (W. P. Cockerell).

*Type*.—U.S.N.M. No. 58440.

*Panurginus costaricensis* Friese is easily distinguished by the yellow tubercles, and *P. parvulus* Friese by the dull head and thorax.

**HETEROSARUS OPACELLUS, new species**

*Male*.—Length about 6.5 mm.; black with no light markings on thorax or abdomen; face below antennae light yellow, the lateral marks bulging upward at the sides (so that the upper margin of the yellow is not straight, as it is in *H. aureifrons*); antennae black, the scape with no light mark; mouth parts black; femora black; front and middle tibiae pale at base, hind tibiae black; tarsi more or less pale, the hind basitarsi brilliant white; thorax above dull, abdomen shining; tegulae dark; wings with the apical half dusky; stigma large, dark brown; nervures brownish, rather thin; second submarginal cell receiving recurrent nervures about equally far from base and apex.

HONDURAS: Zamorano, October 19 (G. Vidales).

*Type*.—U.S.N.M. No. 58441.

By the dull thorax this species resembles *Panurginus parvulus* Friese from San Mateo, Costa Rica; *P. parvulus* was described from the female, 4 mm. long, and I do not believe it can belong with the Honduras insect.

**HETEROSARUS AESCHYNOMENIS, new species**

*Female*.—Length 6 mm. or rather more; entirely black without light markings; head rather broad, face dull; apical half of flagellum brownish beneath; mesonotum polished; tegulae black; wings dusky; stigma large and very dark; first recurrent nervure joining second submarginal cell far from base, but second very near apex; abdomen flattened, shining, the first tergite highly polished; apex with pale hair.

HONDURAS: Zamorano, October (W. P. Cockerell), taken at flowers of *Aeschynomene americana* L. It was also found 8 km. west of Dos Aguas, October (Vidales).

*Type*.—U.S.N.M. No. 58442.

When I first examined this species I thought it was the female of *H. opacellus*, but the shining mesonotum and the position of the recurrent nervures make this impossible.

**HETEROSARUS ZAMORANICUS, new species**

*Male*.—Length about 6 mm.; black, with white markings; the broad

face white, including a supraclypeal band, and lateral marks broad below; region of mouth black; antennae black; a white spot on tubercles, but scutellum entirely black; wings dusky, the whole apical field darkened, not the costapical field alone; legs black; abdomen narrow, black, without bands.

HONDURAS: Zamorano, November 24 (W. P. Cockerell).

*Type*.—U.S.N.M. No. 58443.

This differs from *Panurginus costaricensis* Friese by the white face and from *P. parvulus* Friese by the larger size and the shining thorax.

### Genus CALLIOPSIS Smith

#### CALLIOPSIS HONDURASICUS, new species

*Female*.—Length about 6.5 mm., black, face marks white, faintly yellowish, consisting of a very large one on each side, pyriform, the large end downward, one side on orbital margin, and a rather wide median band on clypeus; antennae black, flagellum ferruginous beneath; hair of head and thorax scanty, dull white; mesonotum dull, with the median groove distinct, scutellum shining; tegulae dark, slightly brownish; wings dusky hyaline; first recurrent nervure joining second submarginal cell about twice as far from base as second from apex; legs black, carrying orange pollen; abdomen broad, convex, entirely black, with short white hair bands at sides of tergites 2 to 4.

HONDURAS: Zamorano, December (Vidales). Also found near Agua Azul by Rua Williams (Mrs. L. O. Williams).

*Type*.—U.S.N.M. No. 58444.

Similar to the species of North America but distinguished by the face marks.

### Genus AGAPOSTEMON Guérin

#### AGAPOSTEMON PROSCRIPTUS Cockerell

*Female*.—Bright green, with bands of white tomentum on abdomen.

GUATEMALA: Antigua, December, two (Pelén). The type locality is Guatemala City.

HONDURAS: Zamorano, January 20 (Dorothy Wylie); also December 17.

A male, Zamorano, March (Adan Rivera) seems to belong here; it has the head and thorax bright green, the abdomen with five broad black bands (the last strongly greenish) alternating with yellow ones (reddened by cyanide in the specimen). The mouth parts are yellow, and the long flagellum is orange beneath and black above; the legs are yellow, including the femora, but the middle tibiae have an elongated black mark near the base, and the hind knees are black.

In Vachal's key this runs nearest to *A. radiatus* Say. It is perhaps to be considered a subspecies of *radiatus*. However, the abdomen of this male has five yellow bands (six in *A. radiatus*).

## AGAPOSTEMON MELANURUS, new species

*Female*.—Length about 9 mm., anterior wing 6.3; head and thorax emerald green; abdomen pure black, the bases of the tergites with sharply defined bands of white tomentum; hair of head and thorax thin, dull white; a band on clypeus, and large spots on bases of mandibles, very pale yellowish; labrum black; flagellum reddish beneath except basally; mesonotum dull and rough, scutellum shining, area of metathorax conspicuously striate; tegulae reddish, with a yellow spot; wings dusky hyaline, stigma dull reddish; legs black, small joints of tarsi reddish, anterior and middle tibiae reddish in front, also apex of their femora; posterior truncation of thorax with transverse ridges.

HONDURAS: Zamorano, October 24, at *Sida acuta* (W. P. Cockerell).

*Type*.—U.S.N.M. No. 58445.

Related to *A. virescens* Fabricius, but abdomen pure black, without white hair on apices of tergites. This appears to be the form regarded by Vachal as the female of *A. nasutus* Smith, but the dusky wings, with dark nervures, and dull mesonotum indicate that this is another species.

## AGAPOSTEMON NASUTUS Smith

*Male*.—Easily distinguished by the peculiar clypeus, the upper margin of which is broadly upturned like a hog's snout; flagellum light yellow beneath, with the last two joints black; head and thorax bright green; legs yellow; abdomen yellow with six black bands.

*Female*.—Green, including abdomen, which has broad bands of whitish tomentum at bases of tergites 2 to 4. Anterior tibiae mainly reddish in front, middle tibiae with a reddish mark anteriorly at end, hind tibiae black (*A. proscriptus* Cockerell, from Guatemala City, has the tibiae and tarsi ferruginous). The female is extremely similar to *A. cockerelli* Crawford, but the base of metathorax is granular, not evidently striate. The sixth tergite is black haired right across.

HONDURAS: Zamorano, very common.

GUATEMALA: Antigua (Pelén).

The species here recognized as *A. nasutus* female is not that of Vachal, but it flies with the very distinctive male; and resembles it in the pallid wings.

## Genus AUGOCHLOROPSIS Cockerell

## AUGOCHLOROPSIS CHORISIS Vachal

Females about 10 mm. long, or smaller; males about 8 mm. Bright green, with closely set short hairs (vibrissae) on the margins of the tergites; tarsi of male white.

HONDURAS: Zamorano, very common; Agua Azul, December 27 (Rua Williams); Galeras, October 19 (G. Vidales); Las Mesas, October 27.

There is no doubt that this is Vachal's *A. choris*, which he says extends from Georgia and Texas to Brazil. But it is very probable that his series was composite, and Vachal himself says the Mexican examples are not quite like those from Brazil. The true *A. choris* must be considered to be the form from Mexico.

Miss Sandhouse in her revision of the United States species<sup>f</sup> of *Augochloropsis* (1937), treats *A. choris* and seven other supposed species as synonyms of *A. cuprea* Smith. Some of these I believe to be distinct, but it is practically certain that *A. choris* is identical with one of F. Smith's species. I now have no material for critical comparison. I have recorded *A. fervida* Smith (of which I saw the type in the British Museum) from Mexico.

### Genus AUGOCHLORA Smith

#### AUGOCHLORA SEMICHALCEA, new species

*Female*.—Length about 10 mm.; head and thorax with purple-blue tints, abdomen with greenish bronze; eyes without hair; head mostly black, with the sides of face and front purplish, and the cheeks, behind the eyes, rich purple; no groove in front of ocelli; supraclypeal area projecting, swollen; antennae black, with apical half of flagellum reddish beneath; pronotum blue above, but mesonotum black, dull; scutellum anteriorly and metathorax purple; hair of head and thorax very scanty, dull white; tegulae dark brown; wings dusky hyaline; stigma dull red; first recurrent nervure going to the extreme apical corner of the square second submarginal cell; legs black; hind spur simple; abdomen bronzy green, second tergite rather broadly black apically, third also blackened apically; coppery tints on second and third tergites.

HONDURAS: Zamorano, at *Ipomoea*, October 29 (W. P. Cockerell).

*Type*.—U.S.N.M. No. 58446.

At first I thought this might be *A. cupriventris* Vachal, but a closer attention to the description showed that this could not be the case. The description of *A. costaricensis* Friese suggests this species, but that species has hairy eyes, and beautiful green and copper-red tints on abdomen.

#### AUGOCHLORA CUPREOTINCTA, new species

*Female*.—Length about 8 mm.; head and thorax bluish green, abdomen brassy, with coppery tints; hair of head and thorax scanty, dull white; clypeus prominent, highly polished, but sides of face and front dull; antennae black; pronotum shining green above, but mesonotum and scutellum dull; posterior face of metathorax shining green; tegulae black; wings dusky hyaline, stigma pale; legs suffused with green; tergites without black hind margins.

HONDURAS: Uyaca Peak, about 5,000 feet (W. P. Cockerell).

*Type*.—U.S.N.M. No. 58447.

Apparently related to the last species, but considerably smaller, with the head and thorax differently colored.

**AUGOCHLORA CENTRALICOLA, new species**

*Female*.—Length about 5 mm.; head and thorax bright green, abdomen darker green; clypeus polished, supraclypeal area with a polished spot; front dull, but a polished spot on each side of base of antennae; antennae black, the flagellum faintly brownish beneath except at base; inner orbits emarginate; mesonotum polished, as also scutellum; area of metathorax shining, with weak striae; tegulae dark; wings hyaline, slightly grayish; stigma brown; nervures rather pale; first recurrent nervure interstitial; legs black at base, anterior knees broadly, tibiae and tarsi pale yellowish; middle and hind tibiae and tarsi pale; hind spur simple; abdomen short, highly polished, without bands or patches of hair.

A male is quite similar; the mandibles are slightly but obscurely pallid; the middle and hind femora, seen from behind, are more or less reddish; the abdomen is practically black beyond the first tergite.

I cannot identify this with any of Friese's Costa Rica species.

HONDURAS: Zamorano (W. P. Cockerell); male (Adan Rivera).

*Type*.—U.S.N.M. No. 58448.

There is some resemblance to *Halictus exiguus* Smith, but the abdomen is quite different (see Ellis, Journ. New York Ent. Soc., vol. 11, p. 219).

I had at first listed this as an *Augochlora*, but later I thought it should go in *Chloralictus*; a closer examination, especially of the eyes, indicates that it is an *Augochlora*. I cannot identify it with any of Vachal's species. Two were taken February 24.

**AUGOCHLORA MICROCHLORINA, new species**

*Female*.—Length about 9 mm.; robust, with short broad abdomen; blue-green, the color rich; front and vertex dull, but clypeus and supraclypeal area shining, with strong punctures; scape long, flagellum thick, reddish beneath except at base; mouth parts black; cheeks, behind eyes, very brilliant shining green; thorax dullish, dorsally with thin white hair; area of metathorax large, shining green, not evidently sculptured but a little rugose toward base; tegulae small, black; wings hyaline, slightly dusky, stigma dusky reddish; second submarginal cell small, second and third together not as large as first; legs black; abdomen shining, the first tergite with a pale reddish suffusion on disc, second with the margin narrowly black; venter black.

HONDURAS: Agua Amarilla, December 15.

*Type*.—U.S.N.M. No. 58478.

Very near to *A. smaragdina* Friese, from Costa Rica, but that has no black margins of tergites. *A. viridinitens* Cockerell from Yucatán has the head mainly black. *A. albiceps* Friese has the end of abdomen with black-brown hair. *A. cupraria* Friese has the abdomen almost black. I cannot identify this with any of Vachal's species. Schwarz (Amer. Mus. Nov. No. 722) discusses *A. smaragdina* as found in the Panama Canal Zone and says that there are very narrow black apices to the abdominal tergites, but I do not think it is identical with our species. The Neotropical species of *Augochlora* are very many, and they have never been contrasted in a single revision, though Vachal's table includes a large proportion of them.

AUGOCHLORA ZAMORANICA, new species

*Female*.—Length about 10 mm.; hind spur with three spines; tergites not vibrissate, head and thorax rather dark bluish green, the mesonotum with two parallel obscure bluish bands on each side of the middle; mesonotum dull, scutellum shining in front, posterior truncation of metathorax, and apical part of basal area shining, more yellowish green, but basal area with a large triangular dull space; pubescence scanty and short, white on cheeks and sides of thorax, but black on vertex and anterior part of mesonotum; face rather narrow; apical half of clypeus black; antennae black, the end of the flagellum red; tegulae with a large greenish spot; wings dusky, stigma dull reddish; legs black; hair on inner side of hind basitarsi very dark, almost black, but a little tuft of pure white at end; abdomen robust, with very little hair, with crimson tints, the margins of the tergites blackened; hair at apex black, but long white hair on venter.

*Male*.—Face shining; antennae very long, black; color of thorax variable, sometimes greener, but usually with the bluish bands on mesonotum distinct, and extending to scutellum; abdomen variable, sometimes strongly reddish; tarsi dusky reddish. The clypeus has an obscure apical yellow band.

HONDURAS: Zamorano, type female, March 8 (Adan Rivera). Males, January, February, March (Vidales, Cisneros, Rivera).

*Type*.—U.S.N.M. No. 58479.

The female differs from *A. auriventris* Friese by the total absence of metallic color on the legs, but the male has the tibiae green on outer side.

AUGOCHLORA CASSIAE, new species

*Female*.—Length nearly 11 mm.; similar to *zamoranica*, with which I had confused it, but a little larger and conspicuously more robust, with a broader face; head and thorax blue, the clypeus, supraclypeal area, and sides of face suffused by black; mesonotum and scutellum dull dark blue; area of metathorax shining, somewhat greenish, with a triangular dark space; tegulae reddish, with a small blue spot in

front; wings dusky hyaline; posterior truncation of thorax shining blue; abdomen shining olive green; hind spur pectinate. Legs with no metallic color.

HONDURAS: Zamorano, October 21, at flowers of *Cassia* (W. P. Cockerell).

*Type*.—U.S.N.M. No. 58480.

These two species belong to the group *Sericei* of Vachal. The description of *A. chryseis* Smith, from Guatemala, nearly applies to this insect, but *A. chryseis* has only the apex of the clypeus black, the base of the metathorax has "longitudinal striae enclosed by a sharp elevated ridge," and the nervures are dark ferruginous.

Schwarz refers bees of the type of *A. vesta* and *A. auriventris*, superficially resembling those now described, to the subgenus *Paraugochloropsis* of Schrottky, but these are vibrissate species, now to be referred to *Augochloropsis*.

#### Genus CAENOHALICTUS Cameron

##### CAENOHALICTUS UYACANUS, new species

*Male*.—Length about 11 mm.; head and thorax green; clypeus, except the black upper margin, light yellow; outer side of mandibles yellow, but ends black; a shining band in front of upper part of each eye; a shining band just above the yellow on face; region behind the ocelli yellowish; coarsely and densely punctured; eyes hairy; mesonotum dull, anteriorly blackish, posteriorly green; scutellum dull; metathorax rugose, the area plicate, but ill defined; antennae very long, black, the scape short, the flagellum with the joints very strongly crenulate, except the basal ones; tegulae shining black; wings hyaline, faintly brownish, second submarginal cell large, broader than high, receiving the recurrent nervure near end; legs black, except the anterior tibiae and tarsi, which are yellow in front; hind trochanters with a strong spine; hind femora extremely stout, with a spine beneath not far from end; hind basitarsi and tibiae at apex with light yellow hair on underside; first tergite dull green, with a black margin; second with the basal half green, the apical half black; third like second, but rather less green; fourth with the green band narrow, the remaining tergites black, the fifth with a narrow pale margin; venter black, fourth and fifth sternites with large processes.

HONDURAS: Top of Uyaca Peak, near Tegucigalpa, March 9 (G. Cisneros).

*Type*.—U.S.N.M. No. 58481.

If we define *Caenohalictus* as "*Augochlora* of the *Sericei* group, with hair on the eyes" (Cockerell, Ann. Mag. Nat. Hist., September 1912, p. 318) this species must go in this genus, though it is distinguished by the very strongly crenulate flagellum, the spines on hind legs, and



the processes on the fourth and fifth sternites. To the four species which I listed in the place cited, *C. serripes* Ducke is to be added. This species, described in both sexes, is considerably smaller than our insect. The hind tibiae of the male are strongly serrate on outer side, which is not at all true of *C. uyacanus*. Eventually, perhaps, *C. uyacanus* will be assigned to a new genus to which *C. sicheli* (*Agapostemon sicheli*) of Vachal will be added. I saw a specimen of *C. sicheli* in the British Museum; it has the clypeus yellowish white except upper margin; labrum yellowish white.

Genus HALICTUS Latreille

HALICTUS LIGATUS TOWNSENDI Cockerell

*Female*.—A black form with a very large head, on the under side of which are two short spines.

*Male*.—Head not enlarged; a yellow band on clypeus.

HONDURAS: Common at Zamorano. Many years ago I described this as *H. townsendi* from Mexico, but Miss Sandhouse, in her revision, considered it a synonym of the common *H. ligatus* of the United States. In my opinion it is a valid subspecies, but it is closely allied to the form from Florida described by F. Smith (1853) as *H. capitosus*. I have no material from Florida for comparison.

HALICTUS (SELADONIA) HONDURASICUS, new species

*Female*.—Length 7.4 mm.; black, slightly greenish, shining; the head, including sides of face, front, occiput, and cheeks, thickly clothed with dull white hair; labrum and mandibles very obscurely brownish; antennae black; clypeus and supraclypeal area exposed, shining, punctured; mesonotum and scutellum shining, the latter very brilliant; area of metathorax large, triangular, the disc dull and granular, the posterior margin broadly shining; tegulae reddish; wings clear hyaline, nervures very pale; second submarginal cell narrow, parallel-sided; stigma fulvous; femora black, tibiae and tarsi dusky reddish; pollen collected, very pale yellowish; abdomen shining, rather narrow, hind margins of tergites with white hair bands, interrupted in middle, bases of second and third tergites with entire bands, exposed base of third tergite reddish.

HONDURAS: Zamorano, January 27 (Adan Rivera).

*Type*.—U.S.N.M. No. 58482.

Compared with *H. pseudovagans*, this is conspicuously less bulky, with a much narrower abdomen. I took it in November at flowers of *Baltimora recta* L.

A male was obtained February 3 (W. P. Cockerell). It has long antennae, obscurely brownish beneath, darkest at end; anterior tibiae and tarsi red; middle and hind tibiae and tarsi dusky reddish, the

tibiae largely black on outer side; abdomen black, with hardly any suggestion of green; hair bands white, interrupted in middle.

When the female abdomen is expanded, the broad red bases of tergites 3 to 5 are exposed, forming broad red bands. I had taken these for a distinct species, but I do not now think they should be separated.

This species is common at Zamorano and was found nesting in the middle of the high road, making vertical tunnels. I thought it might be *H. hesperus* Smith, but the dark, practically black abdomen is different. The anterior margin of the clypeus of the male is not yellow, as it is in *H. agilis* Smith. The front femora of the male are dark, ferruginous apically; in *H. agilis* they are pale ferruginous. The female mandibles are dark and could not be described as ferruginous, as Smith states for *H. vagans* Smith.

HALICTUS (SELADONIA) PSEUDOVAGANS, new species

*Female*.—Length 8 mm.; dark olive-green, the apical part of abdomen practically black; mandibles and antennae black; tarsi red. I wished to identify this with *H. agilis* Smith, which, according to Miss Sandhouse, is the only greenish species of this group in Central America. *H. agilis* was described from the male, but *H. vagans*, on the same page, refers to the female; hence the substitute name *H. errans* Ritsema, is not needed.

At the British Museum I examined the types of *H. agilis* (♂) and *H. vagans* (♀) and made the following notes:

*H. agilis* Smith. A true *Halictus*. Third submarginal cell quite twice as big as second, but very broad at top, and outer side without any distinct double curve; basal nervure not abruptly bent; head, thorax, and abdomen yellowish green; abdomen with apical hair bands on tergites 2 to 5, and basal ones on 2 and 3 at least; tibiae and tarsi, and most of middle and front femora, red, but hind femora dark, abdomen broad basally. Very distinct from any United States species known to me.

*H. vagans* Smith. Second submarginal cell broad, but extremely broad above, the outer margin little curved; hind spur with three teeth, the first stout and spinelike, the second a flattened and rounded lamina, the third a mere rudiment; eyes of typical *Halictus*; stigma very pale honey; abdomen very broad, yellowish green, hind margins of tergites broadly testaceous; base of metathorax minutely rugose-wrinkled, with no large plicae.

Miss Sandhouse records *H. agilis* from Tegucigalpa.

The present species, compared with the above, is a *Seladonia* with pectinate hind spur, shows no testaceous margins of tergites, the band at end of first tergite is mainly on base of second, but laterally on apex of first. The legs are dark, except the red tarsi.

The mandibles are black; they are ferruginous in *vagans*, according to F. Smith, and the flagellum of the antennae is fulvous beneath, which is not at all the case in our species. The scutellum in our species is highly polished and the disc appears black.

Thus there appears to be no doubt that our species is distinct. I cannot identify it with any of those recorded by Friese from Costa Rica.

HONDURAS: Zamorano, October 16 (Cisneros).

*Type*.—U.S.N.M. No. 58483.

Another *Seladonia* found in Central America is *H. hesperus* Smith, of which I noted the female type in the British Museum: Eyes as in *Halictus*; head broad, facial quadrangle about square; hind spur with three broad teeth; abdomen strongly yellowish green, the pale ochraceous bands basal and apical; third submarginal cell much larger than second, but very broad above, with outer margin little curved. The abdomen differs conspicuously from that of the three Honduras species now described.

**HALICTUS UYACICOLA, new species**

*Female*.—Length about 9.5 mm.; black, including mandibles, antennae, and legs; head and thorax with thin but conspicuous dull white hair; head broad, but not excessively so; clypeus moderately shining, but head mainly dull, a shining space on each side above upper margin of clypeus; mesonotum dull, shining in front, median groove distinct in front, but very short; scutellum shining; area of metathorax shining, basally rugose; tegulae black; wings dusky, not reddish; stigma dusky red; third submarginal cell broad, its outer side curved, but without a double curve; legs with pale hair, the scopa on hind legs carrying very pale yellowish pollen; abdomen dullish, the bands of tomentum basal, fulvous, narrow on second and third tergites, on fourth and beyond practically covering the surface; exposed parts of abdomen partly dull, partly shining.

HONDURAS: Uyaca Peak, February 9, over 5,000 feet.

*Type*.—U.S.N.M. No. 58484.

This may be compared with *H. providens* Smith, from Guatemala, but it is evidently distinct, as shown by the following notes on *H. providens*, which I made at the British Museum.

*H. providens*. Hind spur with about five spines. It is an *Evylaeus* with a large broad head, facial quadrangle very much broader than long; third submarginal cell strongly convex on outer side; cheeks broad and subquadrate; mesothorax shining, with very sparse punctures; first abdominal tergite strongly shining, impunctate.

**HALICTUS UYACENSIS, new species**

*Female*.—Length about 10.5 mm.; black, including mandibles, antennae, and legs; head broad, clypeus prominent, its lower margin broadly shining, head otherwise dull, with very scanty pale pubescence; thorax with very scanty whitish pubescence, almost absent dorsally; mesonotum dull, median groove very distinct, with a shining spot at

anterior end; hind border of mesonotum shining; scutellum polished, with the median groove distinct; postscutellum dull; area of metathorax large, with a fine granular sculpture; tegulae black; wings reddish hyaline, stigma dusky reddish, nervures rather dark; third submarginal cell not much wider than second (no wider on marginal), its outer side with a rather indistinct double curve; legs with pale hair, scopa of hind legs full of very pale yellowish pollen; hind spur apparently simple; abdomen somewhat shining, first tergite polished, second to fourth tergites basally with increasingly wide bands of creamy white tomentum, that on fourth covering most of the tergite.

HONDURAS: Uyaca Peak, February 9, over 5,000 feet.

*Type*.—U.S.N.M. No. 58485.

I was at first in doubt whether to refer this to *H. desertus* Smith, but the polished scutellum is distinctive. At the British Museum I examined the type of *H. desertus*, and made the following notes:

*H. desertus*. Hind spur serrate; second and third submarginal cells very broad, third without any distinct double curve on outer margin; area of metathorax merely minutely granular. Looks much like *H. coriaceus* or *politus*, but is smaller; stigma brown, not nearly so yellow, wings not yellow like *politus*.

**HALICTUS ZAMORANICUS, new species**

*Female*.—Length 7.5 mm.; head and thorax dark blue, abdomen black; antennae black; lower part of clypeus black, conspicuously punctured, shining; lower part of supraclypeal area with a polished space, but face and front otherwise dull; eyes of the *Halictus* type; thorax dullish, median groove of mesonotum very distinct; scutellum with two shining spaces; area of metathorax bluer than postscutellum, with a thick rim; tegulae small, shining black; wings hyaline, slightly dusky; stigma dark, but nervures pale brown; abdomen shining, not banded; legs black, scopa on hind legs white, carrying pale yellowish pollen. In certain lights the abdomen seems faintly greenish.

HONDURAS: Zamorano, November 21 (W. P. Cockerell).

*Type*.—U.S.N.M. No. 58486.

There is some resemblance to *H. nigroaeneus* Friese, but the blue color of head and thorax is distinctive. The blue color separates it also from *H. cyanicollis* Friese.

**HALICTUS RUAE, new species**

*Female*.—Length about or nearly 8 mm.; head and thorax with scanty dull white hair, denser on pleura; head, thorax, and first abdominal tergite except broad apical margin dark green; clypeus and supraclypeal area shining; antennae black; mesonotum and scutellum shining; area of metathorax large, crescentic, dull, not ribbed; tegulae pale reddish; wings hyaline, with pale stigma and nervures; first submarginal cell almost as large as the other two

together; second rather narrow; legs basally black, but tibiae and tarsi pale fulvous; hind spur simple; abdomen pale fulvous, except the first tergite, the apex of which is fulvous; apex blackish; thin white pubescence, forming inconspicuous bands at bases of tergites 2 to 4; sides of tergites with blackish clouds.

HONDURAS: Zamorano, the type taken January 23, by Rua Williams. Subsequently taken by W. P. Cockerell, and found to be rather common.

*Type*.—U.S.N.M. No. 58487.

*H. curtulus* Vachal is based on a male from Oaxaca, Mexico, 5 mm. long, the abdomen almost all reddish. It does not seem probable that it is the male of the present species.

*H. placidus* Smith, from Chile, has the head and thorax blue, the abdomen ferruginous. I noted from Smith's type: "♀ has a red abdomen; head and thorax dark blue shaded with purple; eyes moderately emarginate." It is considered a synonym of *mutabilis* Spinola.

#### Genus DIANTHIDIUM Cockerell

##### DIANTHIDIUM HONDURASICUM, new species

*Female*.—Length about 8 mm.; black, with rich yellow markings as follows: a large spot on each side of face, next to orbit (but clypeus and mandibles entirely black), entire band on occiput; very broadly interrupted band on front margin of mesonotum, interrupted band on scutellum, suboval spot at each extreme side of first abdominal tergite, slender curved band, interrupted in middle, on second tergite, very broad bands on tergites 3 to 5, on 3 almost interrupted, these three bands each with a short black transverse stripe; antennae entirely black; tegulae pale reddish with a yellow spot; wings fuliginous, with a clear area in middle; legs black, front and middle tibiae with a yellow stripe on basal half; hind tibiae with dense white hair on inner side; ventral scopa white.

HONDURAS: Agua Amarilla (some say it should be Agua María), December 1 (W. P. Cockerell).

*Type*.—U.S.N.M. No. 58488.

The markings of the abdomen, with small black lines at sides of tergites 3 to 5, resemble those of the widely distributed (Costa Rica to Paraguay) *D. bilobatum* Friese, but in other respects the insect is different. *D. apicale* Cresson, from Mexico, is also similar.

#### Genus MELANTHIDIUM Cockerell

##### MELANTHIDIUM CARRI Cockerell

A second specimen was taken at Agua Amarilla by Geldino Vidales. This large black anthidiine has a yellow band on vertex, and one on scutellum and axillae, but the face is entirely black. By the lack of

pulvilli, the multidentate mandibles, and the second recurrent vein joining the end of the second submarginal cell, it falls nearest to the genus *Anthidium*.

**Genus ANTHIDIUM Fabricius**

**ANTHIDIUM ZAMORANICUM, new species**

*Male*.—Length about 10.5 mm.; robust, black, with yellow markings, those on abdomen a rich canary yellow; clypeus, broad lateral marks, and mandibles yellow, but labrum black; teeth of mandibles black; antennae black, the scape with a yellow stripe; a small yellow spot above each eye; thoracic markings consisting of a short stripe at each side of mesonotum in front, a short line over tegulae, large spots on axillae, and two large spots on scutellum; abdominal marks consisting of a large subquadrate spot on each side and a pair of small transverse discal marks on first tergite; similar marks on the following tergites, but the discal marks successively larger, on third to fifth joined by a line to lateral marks; sixth tergite with a pair of large marks, narrowly joined in middle; sixth tergite with a large black spine on each side; apex with three rather short spines, widely separated; tegulae black, broadly yellow in front; wings dusky, darkest near costa in apical region; pleura densely covered with white hair, hair of vertex and thoracic dorsum very faintly yellowish; legs black, the front and middle tibiae with a yellow stripe on outer side, and hind tibiae with a basal mark; tarsi mainly yellow.

HONDURAS: Zamorano, January 17 (Rua Williams), altitude 2,600 feet.

*Type*.—U.S.N.M. No. 58489.

Related to the Californian *A. tricuspidum* Provancher, but smaller and differing in small details of the markings. It is related also to *A. americanum* Friese from Mexico.

**ANTHIDIUM UYACANUM, new species**

*Female*.—Length about 10 mm.; head black, except for a very large subtriangular yellow mark at each side of clypeus, and a dot above each eye; a band of long white hair along inner orbits; a light band on outer side of mandibles at base; thorax with white hair, dense at sides; mesonotum all black, but scutellum with a pair of transverse yellow marks; tegulae black, with a large pale yellow spot; wings dusky; legs black, the basitarsi appearing light, densely covered with light hair; ventral scopa white; sixth tergite with a short tooth at each side; first five tergites each with four well-separated yellow spots (paler than those on *A. zamoranicum*), the middle ones on tergites 3 to 5 triangular.

HONDURAS: Uyaca Mountain, above prison camp, 5,000 feet altitude.

*Type*.—U.S.N.M. No. 58490.

The two clypeal spots are also found in *A. aztecum* Cresson, but the markings of head and abdomen are different.

**Genus STELIS Panzer**

**STELIS VIDALESII, new species**

*Male*.—Length about 7 mm.; black without light markings on head and thorax, or there may be two hardly noticeable dots on front margin of mesonotum, and a narrow line on scutellum; antennae black; conspicuous white hair at sides of face; mesonotum and scutellum glistening between the punctures; wings with the upper part, except basally, deep fuliginous; legs black; pulvilli present; first abdominal tergite with a slender transverse mark close to margin in middle and a variable dot at each side; second tergite with a larger yellow mark at each side; tergites 4 to 6 with broad, entire, orange-yellow bands.

HONDURAS: Zamorano, December 7 and 19 (W. P. Cockerell); December (G. Vidales).

*Type*.—U.S.N.M. No. 58502.

I had at first referred this to *Dianthidium*, where it falls nearest to *D. agnatum* Cresson, from Mexico. As in *Dianthidium*, the feet have pulvilli, and the second recurrent nervure goes beyond the second submarginal cell. The posterior coxae are not spined. It is somewhat related to *S. shattucki* Cockerell from Yucatán, but the yellow marking is quite different. It can hardly be doubted that *Stelis*, as usually understood, is polyphyletic, and the present species may represent a group derived from *Dianthidium* or a related form.

**Genus HERIADES Spinola**

**HERIADES RUFAPICATUS, new species**

*Female*.—Length about 6 mm., with the apical part of the abdomen covered with red hair. I felt sure that this was *H. rufocaudatus* Friese, but that has tergites 4 to 6 "überall gelbraun behaart," whereas in our species this is true of tergites 5 and 6 but not at all of 4, which is just like 3, bare and shining, with a pale reddish apical band; the second tergite is similarly shining, with the apical band interrupted, and the first has a linear whitish apical band, enlarged to a large patch on each side; facial quadrangle longer than wide, with white hairs at sides; clypeus dull, supraclypeal area shining; tegulae black, wings slightly dusky; hair of thorax white and very scanty; mesonotum feebly shining; base of metathorax polished; ventral scopa rather poorly developed.

*Male*.—5 mm. long; antennae long, reaching base of metathorax; face and front densely covered with white hairs.



HONDURAS: Type female from Zamorano, February (W. P. Cockerell). Also from Uyaca Peak, March 23 (Rua Williams). Male from Tegucigalpa, February 19 (W. P. Cockerell).

*Type*.—U.S.N.M. No. 58503.

Genus **OSMIA** Panzer

**OSMIA ERYTHROTRICHA** Cockerell

GUATEMALA: Río Pensativa, December 18 (A. Pelén). A species with red hair. Described in 1912 from a specimen collected in Guatemala by Juan Rodriguez, the precise locality not stated.

Genus **MEGACHILE** Latreille

**MEGACHILE (ACENTRON) CANDIDA** Smith (det. T. B. Mitchell)

HONDURAS: Zamorano, November 27, January 12.  
Described from Mexico. Female.

**MEGACHILE SIMPLICIPES** Friese (det. T. B. Mitchell)

HONDURAS: Zamorano, January 12. Female.  
Described from Costa Rica. First described as *M. nigrolateralis* Cockerell, but that name had been earlier used for a variety of *M. lachesis*.

**MEGACHILE (CRESSONIELLA) ZAPOTECA** Cresson (det. T. B. Mitchell)

HONDURAS: Agua Amarilla, December 15. Female.  
Described from Mexico.

**MEGACHILE (PSEUDOCENTRON) PRIETANA** Mitchell (det. T. B. Mitchell)

HONDURAS: Zamorano, February 8. Male.  
Described from Honduras.

**MEGACHILE (CHELOSTOMOIDES) OTOMITA** Cresson (det. T. B. Mitchell)

HONDURAS: Zamorano, October 15, November 6, January 14.  
Both sexes.

Previously known from Mexico, and according to Mitchell *M. knabi* Cockerell is the same species. Mitchell records it from Costa Rica.

**MEGACHILE (CHELOSTOMOIDES) PERUVIANA** Smith (det. T. B. Mitchell)

HONDURAS: Zamorano, October 10 and 23. Both sexes.  
Described from Peru.

**MEGACHILE (LEPTORACHIS) near BENIENSIS** Cockerell

HONDURAS: Zamorano and Agua Amarilla (det. Mitchell).

**MEGACHILE (CHRYSOSARUS) near VESTIS** Mitchell

HONDURAS: Zamorano and Agua Amarilla (det. Mitchell).

This and the last are new species, or at least subspecies. It is expected that Professor Mitchell will later provide descriptions.

Genus **COELIOXYS** Latreille

*Coelioxys* males, all with red legs

Margin of scutellum without any median projection; axillary spines small, red; head, thorax, and abdomen entirely black; face densely covered with white hair; antennae black; wings dusky, especially the apical region; nervures and stigma very dark; first recurrent nervure joining second submarginal cell very near base. (Zamorano, January 5, Cisneros.) (Type: U.S.N.M. No. 58504)-----**cisnerosi**, new species

Margin of scutellum with a median projection-----1  
1. Median projection large; axillary spines very large; mesonotum polished, feebly punctured; two triangular patches of white hair at base of scutellum, but no band of hair between scutellum and mesonotum; tegulae red; wings very dark at apex, and in upper half of marginal cell; first recurrent nervure joining second submarginal cell very near base; first tergite red at sides; hind legs black or nearly so, the femora red at end; tergites 5 and 6 with lateral spines. (Zamorano, February 8, W. P. Cockerell.) (Type: U.S.N.M. No. 58505)-----**wilmattae**, new species

Median projection small; axillary spines not so large; mesonotum coarsely and closely punctured; a line of white hair between mesonotum and scutellum, but no triangular patches on the short scutellum; tegulae dusky red; wings dusky, especially at apex; recurrent nervures ending rather distant from base and apex of second submarginal cell; hind legs entirely red; sixth tergite with a spine on each side; first tergite red. (Zamorano, February 24, Adan Rivera.) (Type: U.S.N.M. No. 58506)-----**adani**, new species

These species seem to be distinct from those previously described. All have black mandibles, and that separates them from numerous species. *C. cisnerosi* resembles *C. mexicanus* Cresson in the scutellum but does not have the tergites deeply transversely impressed at apex. The venter is not red, as it is in *C. tepaneca* Cresson.

*C. cisnerosi* is 9.5 mm. long; *C. wilmattae* 10.5; *C. adani* 9 mm. On the apical structures of the abdomen they fall into these groups:

Tergites 5 and 6 with lateral spines; apical tergite elongate, with a deep dorsal sulcus, lateral divisions bidentate at end, no median tooth-----**wilmattae**  
Lateral spines only on tergite 6; apex less produced, with a median spine; lateral apical spines not bidentate-----**cisnerosi** and **adani**

Genus **EXOMALOPSIS** Spinola

**EXOMALOPSIS AZULENSIS**, new species

*Female*.—Length about 8 mm.; black, robust, the thorax dorsally with black hair, but face and sides of front with white; mandibles slightly reddish; antennae black, the flagellum brown beneath, clypeus dull and very densely punctured; upper part of front with long white hair; mesonotum polished posteriorly, dull on front; tegulae black, wings dusky hyaline, a little darker at apex, stigma large, fulvous, veins pallid, second submarginal cell approximately square, very much

smaller than first or third; legs black; scopa of hind legs very large, the basal half yellowish white, the apical half black; pollen collected white or nearly so; abdomen broad and short, shining, first two tergites practically without hair, but the second has on each side a poorly developed oblique line of pale pubescence; third and fourth tergites with broad white hair bands, and apex with white hair; small joints of tarsi red.

HONDURAS: Agua Azul, December (Rua Williams).

*Type*.—U.S.N.M. No. 58507.

I was almost ready to refer this to *E. pulchella* Cresson, described from Cuba, but it differs in the details of the pubescence. The base and sides of first tergite are not clothed with pale hair in our bee. There is a resemblance also to *E. zexmeniae* Cockerell, but the wings are different.

**EXOMALOPSIS DIVERSIPES, new species**

*Female*.—About 10 mm. long; black with middle and hind femora, and first abdominal tergite red (front femora black); wings reddish, the large stigma and the veins very light red; all the hair on dorsum of thorax pale, that of scutellum light red; scopa of hind legs copious, black externally, white on inner side; abdomen with four whitish hair bands, that on margin of first tergite very slender, on second and third very distinct; the second tergite has no oblique hair stripe; clypeus dull; sides of face with white hair; flagellum reddish beneath; tegulae pale ferruginous; wings dusky at end. A variety, from the same locality, has the hair of scutellum white; the maxillary palpi are extremely long.

HONDURAS: Tegucigalpa, February 19 (W. P. Cockerell). The variety with the same data.

*Type*.—U.S.N.M. No. 58508.

The hind basal plate is not very large, but the stigma is very large, and this must belong to *Exomalopsis* sensu stricto. The largely black scape will separate it from related species.

**EXOMALOPSIS FULVOZONATA, new species**

*Male*.—Length about 8 mm.; black, the flagellum obscure brown beneath, and the smaller joints of tarsi red; antennae long and slender; facial quadrangle longer than broad; face densely covered with pale yellowish hair; vertex with a shining space next to eyes; posterior part of mesonotum, and scutellum in front polished; thorax with abundant hair, which is pale fulvous dorsally, thorax beneath with long white hair; tegulae fulvous; wings clear hyaline, except the apical region, which is dusky; stigma large, fulvous; nervures pale; second submarginal cell contracted above; hind legs with abundant black hair, especially on inner side of basitarsi; abdomen without band or spots on first tergite; second and third with broad fulvescent hair bands

on the apical depression; fourth to sixth with inconspicuous fulvescent hair.

HONDURAS: Tegucigalpa, February (W. P. Cockerell).

*Type*.—U.S.N.M. No. 58509.

This belongs to *Exomalopsis* sensu stricto, allied to *E. solidaginis* Cockerell, but known by the two conspicuous fulvous bands on abdomen. There is a remote resemblance to *E. callura* Cockerell.

**EXOMALOPSIS MONOZONULA, new species**

*Male*.—Length about 9.5 mm.; black, including antennae and legs, but tegulae reddish; pubescence white, but very scanty, the thorax practically bare above; abdomen broad, heart-shaped, except that the border of the fifth tergite has a narrow but very conspicuous pure white hair band; the apical plate is fulvous; head shining; facial quadrangle about as broad as long; lower part of clypeus dull and densely punctured, but margin narrowly shining; the antennae are in broad depressions; cheeks highly polished; mesonotum dull in front, posteriorly shining; scutellum with a smooth median line; wings moderately dusky, nervures dark, second submarginal cell very narrow; hind tibiae brownish on inner side; abdomen shining.

HONDURAS: Zamorano, January (W. P. Cockerell).

*Type*.—U.S.N.M. No. 58510.

A distinct species to be compared with *E. otomita* Cresson and *E. limata* Cresson, from which it is known by the single white band on abdomen. The hind legs are not hairy, as they should be in typical *Exomalopsis*.

**EXOMALOPSIS CHIONOCINCTA, new species**

*Female*.—Length about 7.5 to nearly 9 mm.; black, the head and thorax with scanty white hair; abdomen with four white hair bands, that on first tergite narrow, and broadly interrupted, on second not so widely interrupted, on third and fourth entire, very clear white, not broad, at the posterior corner of fifth on each side a small patch of pure white hair; hair on hind tibiae and tarsi black, white on front of tibiae; face rather broad; each side, along orbits, a narrow band of dense white hairs; flagellum bright red beneath; clypeus moderately shining, the lower margin thickened; mesonotum dull, with a shining line posteriorly; scutellum dull; tegulae dark brown; wings hyaline, stigma brown, not very large; second submarginal cell contracted above; abdomen partly shining, but posteriorly dull; the hind knee plate is small.

HONDURAS: Zamorano, type collected by Adan Rivera, also collected by W. P. Cockerell. Specimens were also taken on an adobe wall at the San Francisco finca.

*Type*.—U.S.N.M. No. 58511.

There is some resemblance to *E. otomita* Cresson, but the banding of the abdomen is quite distinctive.

**EXOMALOPSIS FULVESCENS** Smith

*Male*.—HONDURAS: 8 km. west of Dos Aguas (Vidales). One taken December 27. A specimen in the U. S. National Museum was taken by Champion at San Geronimo, Guatemala.

**EXOMALOPSIS WILMATTAE**, new species

*Female*.—Length about 8.5 mm.; black, including antennae, legs, and tegulae; pubescence abundant, grayish white, partly black on mesonotum and scutellum, but whitish on mesonotum posteriorly; eyes very dark brownish; facial quadrangle about as broad as long; clypeus dull; mesonotum and scutellum dull; wings moderately dusky; nervures dark; stigma small; hind knee plate quite large; abdomen broad; first tergite without band, but with a little pale hair at each posterior corner; tergites 2 to 4 with broad dull white hair bands, apex with black hair.

HONDURAS: Zamorano, October 29 (W. P. Cockerell).

*Type*.—U.S.N.M. No. 58513.

In the banding of abdomen it resembles *E. perconcinna*, which is larger and easily distinguished by the red hair on thorax above. It was found at flowers of *Aeschynomene americana* L.

**EXOMALOPSIS RUFITECTA**, new species

*Female*.—Length about 8 mm.; black, the thorax above with black hair, coarse and abundant on scutellum, but face, cheeks, sides of thorax, and collar with dull white hair, hair of labrum white; mandibles dark, with no inner tooth; face and front dull and punctured, the clypeus slightly shining; vertex partly shining, but not broadly polished as in *Diadasia*; flagellum thick, dusky reddish beneath; mesonotum and scutellum shining; tegulae dark; wings subhyaline, dilute fuliginous; stigma small; legs black, the hind tibiae and basitarsi with a long pale yellow scopa, the other legs with pale hair; hind knee plate large; abdomen broad and short; first tergite basally with pure white hair; second and all the following tergites covered with pale red tomentum, without bands or spots.

HONDURAS: Zamorano, at flowers of *Sida acuta* Burm. (W. P. Cockerell). Two specimens.

*Type*.—U.S.N.M. No. 58515.

Related to *E. limata* Cresson, but distinguished by the red tomentum covering abdomen, except at base. *E. limata* is known from Mexico.

**EXOMALOPSIS RUFITECTA** var. **PALLIDITECTA**, new variety

*Female*.—Abdomen with thin pale tomentum, none on first tergite, and on second only at sides; wings dusky; mesonotum shining; apical half of flagellum red beneath.

HONDURAS: Zamorano, December (Vidales).

*Type*.—U.S.N.M. No. 58516.

**EXOMALOPSIS (ANTHOPHORULA) PERCONCINNA, new species**

*Female*.—Length about 10 mm.; black, the flagellum obscurely reddish beneath; facial quadrangle about as broad as long; clypeus dull, a shining line along lower margin of supraclypeal area; hair of face and front dull whitish, of cheeks whiter; mesonotum and scutellum densely covered with bright ferruginous hair, sides of thorax with dull whitish hair; tegulae black; wings dusky, nervures dark, stigma small; second submarginal cell very broad, receiving recurrent nervures at apical corner; scopa of hind legs very large (full of orange pollen), the hind basitarsi with some black hair; abdomen dullish, tergites 2 to 5 with broad sharply defined pale fulvescent bands of fine tomentum with no projecting hairs; sides of extreme base of second tergite with light hair; no oblique marks on second tergite; hind knee plate small.

HONDURAS: Agua Amarilla, December 15.

*Type*.—U.S.N.M. No. 58512.

Somewhat related to *E. fulvescens* Smith, which is smaller, with shaggy abdominal bands, and with dorsal hair not bright red.

**EXOMALOPSIS (ANTHOPHORULA) NITIDICINCTA, new species**

*Male*.—Length about 8.5 mm.; black, with clypeus lemon-yellow, with a notch in the yellow on each side above, base of mandibles with a large triangular yellow mark; flagellum red beneath; front legs brownish in front; facial quadrangle higher than broad; mesonotum and scutellum dull; hair of head and thorax copious, rather dull white; tegulae testaceous, rather large; wings dusky, but not very dark; stigma reddish, nervures dark brown; second submarginal cell large, its basal side oblique; lower section of basal nervure very straight, curved only briefly at lower end; hair of legs white; abdomen, broad seen from above almost circular, rather thinly covered with pale, slightly fulvescent hair, hind margins of second and following tergites shining, the pubescence dense enough to give the effect of bands; no oblique bands on second segment.

HONDURAS: Zamorano, November 21 (W. P. Cockerell). Two specimens.

*Type*.—U.S.N.M. No. 58514.

Related to *E. texana* Friese, but differing in the dusky wings with dark nervures and in the abdominal bands.

**EXOMALOPSIS (or new genus near MELISSODES) FULVOTECTA, new species**

*Female*.—Length about 12 mm.; black, with the abdomen beyond the second tergite (and on margin of that tergite) rufous from a covering of fine tomentum; clypeus with a pale yellow band covering more than apical half, and with a pointed extension upward in middle;

sides of face, occiput, and cheeks with white hair, hair of thorax black; flagellum thick, obscurely reddish beneath; labrum basally yellow, but mandibles black; mesonotum closely punctured; tegulae dusky rufous; wings short, reaching about to third tergite, dusky but not very dark; nervures dark; stigma very small; second submarginal cell very much smaller than first or third, receiving the first recurrent nervure a short distance from its end, the second about equally distant from end of third submarginal; hair of front and middle legs dark, but the copious scopa of hind tibia pale yellowish; hind basitarsi with hair of the same color; first tergite without a sharp keel bounding declivity; first two tergites black, not covered with fulvous hair; apical plate large, rounded at end; sides of fifth sternite with long hair; maxillary palpi short and slender, probably 4-jointed.

HONDURAS: Zamorano, October 19 (G. Vidales).

*Type*.—U.S.N.M. No. 58517.

Only one specimen was taken, and when I examined it I did not know what genus to refer it to. It is unique by the largely yellow clypeus of the female and the fulvous tomentum of the abdomen beyond the second tergite; the abdomen is rather long and narrow, not like that of an *Exomalopsis*. When both sexes are known, it will probably be referred to a new subgenus or genus. Certainly the stigma and palpi are not like those of *Exomalopsis*.

### Genus LEPTERGATIS Holmberg

#### LEPTERGATIS TOLUCA Cresson

HONDURAS: San Francisco finca on adobe wall, October 30, November 10, 9♀, 6♂. Also a female taken at Zamorano by W. P. Cockerell.

### Genus NOMADA Scopoli

#### NOMADA TENUICORNIS, new species<sup>2</sup>

*Female*.—Length nearly 8 mm.; with canary yellow markings, as follows: Clypeus, labrum, mandibles except apex, broad lateral face marks continuous over top of eye with the postocular band, upper border of mesonotum, tubercles, mesopleura, scutellum, postscutellum, spots on axillae, spots on the pale red tegulae, very broad bands on metathorax leaving the triangular basal area and a band down the

<sup>2</sup> Upon his return from Honduras in 1947, Professor Cockerell described four specimens of *Nomada*, collected at Zamorano, Honduras. He then turned the specimens over to me with the request that I make such comments upon them as might seem appropriate, these comments to be included with his manuscript.

Three of the specimens were described as types of new species and the fourth as a variety of a previously described species of E. T. Cresson. I am not in a position to comment on *N. tenuicornis*, as it is the first non-*Micronomada* specimen from outside the limits of the United States I have had occasion to examine.

The two remaining new species and the new variety may be assigned provisionally to the subgenus *Micronomada*. Although not all of them have "strong coxal spines" on the front coxae, they are somehow allied to *Micronomada* as constituted in North America. They, with Cresson's *limata*, several unidentified Caribbean specimens that I have examined in various collections, and some species described from South America, seem to form a group of species represented vaguely in the United States but apparently much



middle black; antennae long and slender, reaching scutellum, light ferruginous; face broad, shining, a small spot in supraclypeal region; mesonotum dull, not at all polished; wings slightly dusky, darker, but not very dark at apex; stigma pale red; legs mainly yellow, but femora darkened, and also inner side of hind tibiae and basitarsi; hind coxae very large, yellow above, black beneath; abdomen with five yellow bands, the intervals black, first two bands very broad, third and fourth narrow, fifth very broad, venter yellow, with three black bands.

HONDURAS: Zamorano, at flowers of *Euphorbia* (W. P. Cockerell).

*Type*.—U.S.N.M. No. 58519.

A distinct species, the female with rather the aspect of a male. There is perhaps some affinity with *N. pampicola* var. *flavescens* Friese, very briefly described from Costa Rica, but it appears not to be identical.

NOMADA LIMATA Cresson XANTHASPIS, new variety <sup>2</sup>

*Female*.—Length about 7 mm.; markings pale yellow, consisting of lateral face marks, narrow above, broad below and curving away from orbit, a spot on clypeus (sometimes absent), upper border of pronotum, tubercles, an oval spot on pleura, nearly all of scutellum, postscutel-

more numerous in Mexico, the Caribbean area, and Central and South America. The group may prove to be separable from *Micronomada*, but the characters by which it might be distinguished become less apparent in the United States. Ideally the group is characterized by a planing of the face, usually with sparse, shallow facial punctures, by a humpbacked appearance resulting from a depression of the middorsum of the pronotum which is overhung by the middorsum of the mesonotum, by the spatulate bristles at the apex of the hind (often the middle) tibiae, and by the darkening of the costal, rather than the apical, half of the forewing. They do not seem to show complete uniformity in the presence of anterior coxal spines, in the degree of flattening of the face, or the density of facial punctures.

Cresson's *limata* from Mexico belongs to this group. The outstanding characters of the type are the dirty-white markings, the sparse punctation of the face and nearly impunctate shining mesonotum, the flat unlobed scutellum, expanded coxae, and short broad scalelike spines at the apex of the hind tibiae. In view of Cockerell's description of a new variety of the species, the published records and synonymy of *limata* are here reviewed:

CRESSON, Trans. Amer. Ent. Soc., vol. 7, p. 76, 1878. ♀, Mexico (Sumichrast).

COCKERELL, Trans. Amer. Ent. Soc., vol. 24, p. 151, 1897. ♀, San Rafael, Veracruz, Mexico, March 8, on *Bidens* (Townsend). (*N. montezuma* Smith considered a synonym.)

COCKERELL, Proc. U. S. Nat. Mus., vol. 39, p. 651, 1911. Sex not mentioned, probably female, Brownsville, Tex., November 24, 1909 (F. C. Pratt). (*N. pampicola* Holmberg (Paraguay) considered closely allied.)

*Nomada limata* var. *xanthaspis* Cockerell (♀) differs from *limata* only in minor characters of which the yellow, rather than white, maculation is most apparent. Cockerell, *loc. cit.*, recorded a yellow *limata* from Veracruz. The more extensive scutellar spots and the smaller size are also likely to be within the range of specific variation.

*Nomada zamoranica* Cockerell (♂) at first glance might be assumed to be the undescribed male of *limata*. It differs from *limata* in the strong punctation of face and mesonotum, in the protuberant and bilobed scutellum, and in the long, slender spines of the anterior coxae. Whether these are possibly only sexual differences must be decided with the help of more numerous specimens but their presence in the related female specimen next discussed suggests that they are real specific differences.

*Nomada hondurasica* Cockerell (♀) is also superficially very similar to *limata* but differs in so many particulars that it may well be considered a separate species. It is more extensively marked with yellow than *limata*, *l. xanthaspis*, or *zamoronica*, on head, thorax, and both dorsum and sternum of the abdomen. The strong punctures of face and mesonotum, the prominent, bilobed scutellum, and the long slender coxal spines are like those of *zamoronica*. I should be tempted to consider this the female of *zamoronica* if it were not for the fact that in my experience males are likely to be more extensively light-marked than the females of the same species.—HUGO G. RODECK, University of Colorado Museum.

lum, apical bands on first two tergites, a weak basal band on fourth, and a broader interrupted one on fifth; antennae reddish at base, tegulae dusky reddish; legs black; mesonotum highly polished, impunctate; upper half of anterior wings broadly fuliginous.

HONDURAS: Zamorano, January (Dorothy Wylie). Two specimens.

*Type*.—U.S.N.M. No. 58518.

This differs from Cresson's description (based on a female from Mexico) in that the scutellum is practically all yellow instead of having "a bilunate line," and the markings are yellow, not white. Yet I can hardly doubt that the species is the same. In some other descriptions, Cresson says white in place of yellow, perhaps the result of working by artificial light. The Honduras form, on account of the rich yellow scutellum and postscutellum, may be called variety or subspecies *xanthaspis*.

**NOMADA ZAMORANICA, new species<sup>2</sup>**

*Male*.—Length about 8 mm.; with yellow markings as follows: Large triangular mark on clypeus, slender lateral marks, curving inward below, along upper part of orbits, band on upper border of pronotum, tubercles, large spot on hind part of mesopleura, the swollen scutellum, and postscutellum; abdomen black with six yellow bands, the second broadest; antennae mainly black but scape and base of flagellum dusky reddish; face flat; mesonotum shining, very coarsely punctured, the hind part with a very deep median groove; sides of metathorax with fine whitish tomentum; tegulae chestnut-red; anterior wings with the upper part broadly fuliginous; stigma dusky, inconspicuous; legs black, the femora red in front, tarsi with fine pale pubescence; under side of abdomen shining black, without bands.

HONDURAS: Zamorano, January 19 (W. P. Cockerell).

*Type*.—U.S.N.M. No. 58520.

There is some resemblance to *N. aztecorum* Cockerell, from Mexico, but that is much larger and differs in the details of coloration.

**NOMADA HONDURASICA, new species<sup>2</sup>**

*Female*.—Length about 7 mm.; yellow markings as follows: Very large club-shaped marks on upper part of face and front (but clypeus all black), upper border of pronotum, tubercles, large spot on mesopleura, scutellum, postscutellum, and five bands on abdomen, the second and third broad at sides and slender in middle; under side of abdomen black, the third and fourth sternites with interrupted pale bands; antennae dusky reddish beneath, scape with a pale stripe; mesonotum dull, very finely punctured; tegulae dark, with a large

<sup>2</sup>See footnote 2 on p. 456.

yellow spot; wings with the apex broadly fuliginous; stigma red; anterior femora in front and their tibiae and tarsi red, middle legs mainly red, but femora and tibiae with dusky suffusion behind; hind legs black, the tibiae red at base, and with a pale yellow spot at apex; middle coxae with a light spot.

HONDURAS: Zamorano, January 21 (Adan Rivera).

*Type*.—U.S.N.M. No. 58521.

In having a black clypeus and sides of face yellow this resembles *N. krugii* Cresson, from Puerto Rico, but the details of the markings are different.

**Genus EPEOLUS Latreille**

**EPEOLUS ALBOPICTUS, new species**

*Male*.—Length about 7 mm.; black, the pubescent markings white, consisting of a broad band across face, a band on upper margin of pronotum, margin of tubercles, marginal band at sides of and behind mesonotum (but no discal lines), band on hind margin of scutellum, one on postscutellum, rather broad curved band across middle of pleura, a little white hair at upper part of sides of metathorax, hind coxae, outer side of tibiae, and six abdominal bands, rather narrow except on first tergite, the apical half of which is covered with dense white tomentum, except for a large rounded incision anteriorly in middle, nearly dividing the white into two portions; antennae black; mesonotum dull; tegulae very dark brownish; wings reddish hyaline, nervures dark; legs black; apical plate of abdomen very large and broad.

HONDURAS: San Francisco finca, near Zamorano, November 3 (W. P. Cockerell).

*Type*.—U.S.N.M. No. 58535.

Quite distinct by the very broad band on first tergite.

**EPEOLUS RUGOSUS, new species**

*Female*.—Length about 9 mm.; black, with the pubescent markings white, the bands on second and third tergites yellowish; flagellum very obscurely reddish basally; face with grayish white hair; band on upper margin of pronotum slender, broken in middle; posterior margin of mesonotum with white hair, but no discal stripes and no line over tegulae; posteriorly the thorax has a tuft of white hair at each side of scutellum, and below this a V-shaped mark placed sideways so that the point is directed outward; disc of thorax rough and coarsely punctured; pleura with a transverse white band; each shoulder of first tergite with a large pure white patch (contrasting with the dull yellowish of the band on tergites 2 to 4), these patches far apart but connected by a faint, hardly perceptible lines of pubescence; tegulae bright ferruginous; wings hyaline with pale reddish veins, a little dusky spot at apex; legs mainly black, but tibiae and tarsi partly red; hind spurs whitish.

HONDURAS: Zamorano, December 14 (Vidales).

*Type*.—U.S.N.M. No. 58536.

Easily known by the rough mesonotum and markings of first tergite, which are entirely different from those of *E. albopictus*.

**Genus TRIEPEOLUS Robertson**

**TRIEPEOLUS ANTIGUENSIS, new species**

*Male*.—Length about 9.5 mm.; markings white, silvery white on face, somewhat flavescent on abdomen; legs and antennae black, small joints of tarsi brownish; upper border of prothorax with a broad band of tomentum, which extends more or less around tubercles; mesonotum dull, with two parallel light bands on anterior half, and a rather weak band along sides and posterior margin; scutellum dull, somewhat bigibbous, the axillary spurs short; tegulae shining, brownish; wings dusky hyaline; first recurrent nervure joining middle of second submarginal cell; legs with white hair, conspicuous on hind knees, and base and apex of middle tibiae; first tergite with broad bands of pale tomentum at base and apex, the basal one narrowly interrupted, the apical one broadly, these bands narrowly meeting at sides; band on second tergite narrowly interrupted, those on third to sixth entire; apical plate long, parallel-sided, black.

GUATEMALA: Antigua, December 26 (A. Pelén).

*Type*.—U.S.N.M. No. 58537.

In the white markings this resembles *T. intrepidus* Smith, but the absence of ferruginous color distinguishes it.

**TRIEPEOLUS BILINEATUS, new species**

*Female* (type).—About 10 mm. long; markings of head and thorax rather dull white, of abdomen pale yellow; tegument of head all black, but base of flagellum red; tubercles and tegulae also red; white pubescence on upper part of clypeus and between antennae and orbits; the light markings of thorax consist of a narrow band on upper margin of pronotum, two parallel discal stripes on mesonotum, reaching about halfway from the front, narrow marginal bands on mesonotum, band on hind margin of scutellum, narrower one on postscutellum, rather broad vertical stripes at sides of metathorax and a transverse band on upper part of mesopleura; wings reddish, slightly dusky at apex; femora black, tibiae and tarsi dusky red, spurs black; mesonotum dull; light markings of abdomen consisting of large curved patches, widely separated, on base of first tergite, apical bands on tergites 2 to 4, the first two broad; apex of abdomen slightly reddish; sternites 2 to 4 with fine pubescence, appearing grayish.

*Male*.—Resembles the female; abdomen with five bands, four yellowish, the last whitish; fourth and fifth sternites with fringes of curved hairs; apex of wings darker.

HONDURAS: Zamorano, January (Adan Rivera).

*Type*.—U.S.N.M. No. 58538.

Related to *T. flavofasciatus* Smith, from Oaxaca, Mexico, but that has the mandibles and scape red, and a band on first tergite.

**TRIEPEOLUS BILUNATUS**, new species

*Female*.—Length about 10 mm.; with markings like those of *T. bilineatus*, except that the longitudinal stripes on mesonotum are wholly absent; base of flagellum red; mesonotum dull; axillae prominent, pointed; sides of metathorax with slender vertical pure white stripes, curved outward at upper end; marks on pleura crescentic; first tergite with a pair of very large, obliquely placed, semilunar marks, approaching but not meeting in middle line; tergites 2 to 4 with pale yellowish apical band.

HONDURAS: Zamorano, January 17 (W. P. Cockerell).

*Type*.—U.S.N.M. No. 58539.

I was almost ready to refer this to *T. mexicanus* Cresson, which it closely resembles, but that species has the sides of the metathorax covered with dense yellowish pubescence.

**Genus MELITOMA** Lepeletier and Serville

**MELITOMA FULVIFRONS MARGINELLA** Cresson

Black, with four narrow, pure-white bands on abdomen; hair of thorax grayish, the scutellum with black and the mesonotum with a broad, black V; hair of face variably reddish; mouth parts very long, reaching base of abdomen, held under body like the beak of an hemipteron, not capable of being folded up like a knife.

HONDURAS: Zamorano, excessively abundant nesting in an adobe wall at the San Francisco finca.

I follow Schwarz (Amer. Mus. Nov. No. 722, 1934) in referring the northern form of *M. fulvifrons* to *marginella* Cresson, without at the present having any means of investigating the matter. I have sent a long series of these bees to the National Museum, and they will eventually be helpful in determining whether there is more than one Central American race.

**MELITOMA NUDICAUDA**, new species

*Female*.—Length about 11 mm.; similar to *M. fulvifrons*, with the same long mouth parts, but abdomen wholly without bands, although the first tergite has much white hair on basal part. Size larger, face broader, its hair not at all reddish; mesonotum strongly polished in front (it has the broad black V as in *M. fulvifrons*); second submarginal cell broader; apical part of wing distinctly dusky.

HONDURAS: Zamorano, October 12, at flowers of *Thunbergia erecta* (Geldino Vidales).

*Type*.—U.S.N.M. No. 58540.

Genus **DASIAPIS** Cockerell**DASIAPIS OLIVACEA** Cresson

*Female*.—HONDURAS: Zamorano (W. P. Cockerell). I take this to be the female of *D. olivacea*. It is easily distinguished from *Exomalopsis rufitecta* by the dull mesonotum and the tomentose first tergite. The tegument of the face is black, and the upper margin of the clypeus is shining; there is a deep groove between the clypeus and supraclypeal area. It flies in October, November, and December.

*Male*.—HONDURAS: Zamorano, October 22 (Vidales). The male has a light yellow clypeus.

Genus **MELISSODES** Latreille**MELISSODES AURESCENS**, new species

*Female* (type).—Similar to *M. aurigenia* Cresson; hair of thorax dorsally ferruginous, varying in the intensity of the color; head broad; flagellum dull rufous beneath; abdominal hair bands well developed, the broad one on fourth tergite with a bare space in middle; scopa on hind tibiae and basitarsi pale reddish; mesonotum polished anteriorly; tegulae dark brownish; wings dusky, nervures dark.

*Male*.—Clypeus pale yellow, as also labrum and a large mark on mandibles; antennae very long, reaching base of second tergite, clear red beneath.

HONDURAS: Zamorano, common. On January 14, I took two at flowers of *Ipomoea murucoides*, a species with large white flowers. The type was taken by W. P. Cockerell.

*Type*.—U.S.N.M. No. 58541.

**MELISSODES AURESCENS** var. **A**

*Female*.—Length about 11 mm.; rather robust; black, the flagellum obscurely reddish beneath; facial quadrangle almost square; clypeus dull, with a median keel; vertex shining; head with pale grayish hair, that on labrum (which is black) reddish; thorax with the dorsal hair reddish, especially anteriorly; scutellum, postscutellum, and metathorax shining; tegulae small, black; wings faintly dusky, nervures black; second submarginal cell rather large, the basal side oblique; first recurrent nervure joining second submarginal cell near end, and second recurrent joining third submarginal about as far from end; legs black, the copious scopa on hind tibia and basitarsi very pale fulvescent, but hair on apical part of basitarsi black; abdomen broad, shining, with dull white hair, on first tergite at base and sides, and a little patch at hind corners; on second a weak band at extreme base and an interrupted band across disc, on third and fourth with very broad bands, not interrupted, apex with black hair; black areas before bands on tergites 3 and 4 not pubescent.

HONDURAS: Agua Amarilla, November 17 (Vidales).

This is almost the same as *M. aurescens*, but the head is not so broad, and the facial quadrangle is more nearly square. I thought this might be a distinct species, but with only a single specimen this appears doubtful. The color of the hair on thorax above distinguishes it from *M. raphaelis* Cockerell.

**MELISSODES PERSIMILIS**, new species

*Female*.—Like *M. aurescens*, but head narrower; tergites 4 and 5, before the bands, with a thin whitish tomentum, lacking in *M. aurescens*; hair bands on tergites 3 and 4 very broad, that on 4 without a bare spot in middle.

HONDURAS: Agua Amarilla, November 17 (Vidales).

*Type*.—U.S.N.M. No. 58542.

**MELISSODES PERPLEXANS**, new species

*Female*.—Length about 11 mm.; robust, black, with the usual short antennae of this sex, the flagellum very obscurely brownish beneath. I at first considered this the female of the last, but it differs in several characters which seem to indicate another species, head very broad, the facial quadrangle much broader than long; clypeus dull; second submarginal cell broader, receiving the recurrent nervure at a greater distance from the end; pale hair band on second tergite narrow and broadly interrupted; bands on third and fourth broad and dense, fifth without a band.

HONDURAS: Uyaca Peak, February 9 (W. P. Cockerell).

*Type*.—U.S.N.M. No. 58543.

**MELISSODES GRISEIHRTA**, new species

*Male*.—Length about or almost 9 mm.; black, the head and thorax densely covered with long gray hair, but pure white on cheeks and occiput; clypeus pale lemon-yellow, labrum and mandibles black; antennae long, reaching at least the end of first tergite, flagellum clear red beneath; facial quadrangle about square; mesonotum dull in front, posteriorly shining; metathorax dull; tegulae dark; wings hyaline, faintly dusky, nervures and stigma very dark; marginal cell obliquely truncate, the apex far from vertex; first submarginal cell a little longer than third, second about square, receiving recurrent nervure no great distance from end; legs slender, black, the claw joint reddened; abdomen black, rather broad, margins of tergites dark brown; tergites 2 to 5 with rather weak hair bands, and margins of first at sides with pale hair; margins of the tergites shining; apical plate broad, dark brown.

HONDURAS: Uyaca Peak, March 9 (Morales).

*Type*.—U.S.N.M. No. 58544.



**MELISSODES FLAVIFASCIATUS, new species**

*Male*.—Length about or nearly 9 mm.; black, the clypeus with a broad yellow apical band, but the labrum and mandibles black; antennae black, very long, reaching at least to middle of abdomen, the flagellar joints swollen; hair of head and thorax long and white, on thorax above somewhat dusky; facial quadrangle about square; mesonotum and scutellum moderately shining; tegulae black; wings hyaline, faintly dusky, nervures dark; second submarginal cell large, quadrate, receiving recurrent nervures not far from end; second submarginal broader on marginal than third; legs black, with thin white hair, claw joint reddened; abdomen shining, first tergite with no band, tergites 2 to 5 with apical white hair bands; second with no discal band.

HONDURAS: Zamorano, October 19 (M. R. Palacios).

*Type*.—U.S.N.M. No. 58545.

*M. tenuimarginata* Friese has the antennae black, but not nearly so long as in the present species.

**MELISSODES TENUICINCTA, new species**

*Female*.—Length about 10.5 mm., width of abdomen about 5.5; black, the flagellum obscurely reddish beneath, the small joints of tarsi reddish; face broader than long; clypeus dull, but region above it partly shining; tongue elongate, curved downward at end; maxillary blades long and slender; mesonotum mainly dull, not hairy, but hind part of thorax and pleura densely covered with dull white hair; tegulae large, reddish, the margins pallid; wings strongly dusky; inner side of second submarginal cell strongly oblique, so that the cell is contracted above; third submarginal cell a little wider on marginal than second; legs with pale, slightly yellowish hair; scopa on hind legs large; abdomen shining, the margins of the tergites very narrowly pallid, but no distinct bands; fifth tergite and apex with pale red hair.

HONDURAS: Zamorano, December (Vidales). Also taken by Pelén.

*Type*.—U.S.N.M. No. 58546.

**MELISSODES PELÉNI, new species**

*Female*.—Length about or nearly 10 mm.; facial quadrangle about square; clypeus dull above, but the lower part shining, with a distinct but delicate keel; head with scanty white hair, but on each side of face a large triangular patch of white hair; flagellum reddish beneath; anterior part of mesonotum, and region of scutellum, with red hair; mesonotum posteriorly, and scutellum in front, exposed and shining; pleura with white hair; tegulae shining red; wings hyaline, suffused with red; stigma and nervures light red; marginal cell very broadly and obliquely truncate; second submarginal cell small, third very long; legs black, with the small joints of tarsi red; hair of legs black

and white, broadly white on hind tibiae and basitarsi anteriorly, black posteriorly; on hind basitarsi the large pure white anterior part is sharply divided from the black, the line of meeting being oblique, the white area broadest at the base; the white hair on anterior and middle tibiae and tarsi is not so dense as on hind legs, and thus appears grayish white; abdomen rather broad, with very distinct but not very broad white hair bands on tergites 2 to 4; margin of fifth narrowly white; apex with black hair.

GUATEMALA: Antigua, December 28, 1946 (Amado Pelén).

*Type*.—U.S.N.M No. 58547.

A very distinct species, readily known by the arrangement of black and white on the hind legs.

**MELISSODES ANTIGUENSIS, new species**

*Male*.—Length 10 mm.; antennae long, reaching hind margin of second abdominal tergite, flagellum broadly clear red below; head broader than long; clypeus pale yellow, rather short; labrum black; vertex polished; thorax above with dull fulvous hair, sides (and also cheeks) with white hair; tegulae dark; wings dusky, nervures and margin of stigma dark; legs black, the large apical joints of tarsi red; hair of legs pale grayish; abdomen with narrow, slightly fulvescent hair bands, with hyaline margins beyond the bands.

GUATEMALA: Antigua, October 19, 1946 (Amado Pelén).

*Type*.—U.S.N.M No. 58548.

At first I took this for the male of *M. peléni*, but the wings and some other characters are quite different.

**MELISSODES GALERENSIS, new species**

*Male*.—Length about 7.5 mm.; antennae long, about reaching second tergite of abdomen; black, the head without light markings; face, cheeks, and occiput with much white hair, labrum with dense white hair; mandibles slightly brownish; flagellum red beneath; mesonotum dull; thorax with abundant white hair; tegulae small and dark; wings dusky hyaline; stigma practically obsolete; first recurrent nervure reaching second submarginal cell very near end; second submarginal cell a little narrowed above; legs black, with white hair; abdomen broad, the fourth to sixth tergites with conspicuous white hair bands; apical plate dark, broadly truncate; the second tergite has a weak, interrupted hair band.

HONDURAS: Galeras, October 19 (G. Vidales).

*Type*.—U.S.N.M. No. 58549.

Nearest, perhaps, to *Tetralonia magnicornis* Friese from Arequipa, but much smaller, and with the clypeus not elongated. It may, of course, be the male of one of the many species described from the female sex.

**MELISSODES NEGLIGENDA, new species**

*Female*.—Robust, black, 11.5 mm. long; the thorax above with dense bright ferruginous hair; antennae black, flagellum reddened beneath; hair of head white, long, black above; head broad and short, face dull; mesonotum dull; tegulae ferruginous; wings strongly dusky, nervures black; second submarginal cell large, basal side oblique, side on marginal larger than third on marginal; first recurrent ending a moderate distance from apex of cell; second recurrent interstitial; legs with black hair, scopa of hind legs small; abdomen broad, fourth tergite with a very broad white band, interrupted in middle; the other bands absent or rudimentary.

HONDURAS: Agua Amarilla. Three specimens; the type March 15 (A. Carr). Also March 17 (Vidales).

*Type*.—U.S.N.M. No. 58550.

**MELISSODES (sensu lato) CRASSIDENTATA, new species**

*Male*.—Length about 11 mm.; black, the head without light markings; antennae black, short for a male, reaching about as far as tegulae; clypeus moderately shining, facial quadrangle about square; hair of thorax abundant, dull white, slightly fulvescent above; tegulae rather large, pellucid testaceous; wings ample, dusky, nervures dark; tibiae with pale hair, hind basitarsi with black hair; abdomen broad, shining, with white hair on first tergite; two distinct bands on each side of abdomen; toward apex at sides two prominent teeth; apex with a large truncate plate.

HONDURAS: Zamorano; three specimens. The type taken by W. P. Cockerell in the latter part of October.

*Type*.—U.S.N.M. No. 58551.

I thought at first this might be the male of *M. negligenda*, but it comes from a different locality and differs in too many respects. It is considerably smaller than *M. assimilis* Smith, with shorter antennae. The marginal cell is longer and relatively narrower than in *M. atrata* Smith.

**MELISSODES ALBOMARGINALIS, new species**

*Male*.—Length about 9 mm.; antennae long (about 8.4 mm.), reaching base of abdomen; flagellum slender, red beneath; head broader than long, densely covered with long white hair; clypeus pale yellow, higher than in the related species; labrum pale yellow; thorax densely covered with long white hair, fulvescent or reddish dorsally; tegulae small and dark; wings dusky, nervures dark; marginal cell broad, with a rounded (not truncate) end; second submarginal cell rather large and broad; legs black, including tarsi; hair of legs rather dull white; abdomen convex, moderately shining, hind margin of first tergite shining, not banded, but with some pale hair at posterior corners; second and following tergites with rather broad even bands

of dull white hair, those on the apical margins of the tergites with no smooth space beyond, and no pale hair anterior to the bands.

HONDURAS: Agua Amarilla (W. P. Cockerell). Two specimens.

*Type*.—U.S.N.M. No. 58552.

The clypeus is much larger than in *M. albicaudus*.

**MELISSODES ATRIPICTA**, new species

*Female*.—Length about 10 mm.; robust, black, the tarsi reddish at end; mandibles with a long red streak above; head broad, clypeus dull, in some lights slightly shining above; flagellum obscurely reddish beneath; vertex polished; scutellum anteriorly and mesonotum posteriorly polished; postscutellum with a brilliantly shining spot which is at the end of an eminence; metathorax shining; face covered with thin hair, appearing grayish, cheeks with white; top of head with long, black hair; occipital region with white hair; mesonotum and scutellum with black hair, but white hair in region of axillae; tegulae black; wings dusky, especially dark at apex; marginal cell with broadly rounded apex, away from costa; second submarginal cell very broad, receiving first recurrent nervure not far from end; legs with black hair, except that on hind tibiae and basal part of tarsi it is pale reddish; abdomen shining, with dull white hair at bases, extreme bases of second and third tergites with narrow band of dull white hairs, very broadly interrupted on second; fourth tergite with pale gray bands in front and behind, and between them a bare area, pointed at sides; apex of abdomen with black hair.

HONDURAS: Zamorano, November (Pelén).

*Type*.—U.S.N.M. No. 58553.

This may eventually be taken as the type of a new genus or subgenus. Ducke, in his excellent account of the Neotropical genera of bees (1912), recognizes a genus *Tetralonia* Spinola, in which he includes *Melissodes*, *Thygater*, *Peponapis*, *Anthedon*, *Xenoglossa*, and several other groups which have been regarded as genera. Michener, in 1944, has a tribe Eucerini, including the genera (found in the United States) *Tetralonia*, *Xenoglossa*, *Peponapis*, *Cemolobus*, *Melissodes*, *Xenoglossodes*, *Anthedonia* (*Anthedon* preoccupied), *Florilegus*, and *Martinapis*. It will be seen that most of these segregate genera contain species which visit particular flowers. How far to go in the subdivision of such genera is a matter of uncertainty. Many bees that Michener regards as of subgeneric rank could be treated as genera.

It now appears that in Central America there is a series of segregate forms, which probably deserve to be made types of genera. In this paper, however, I have followed in the main the method of Ducke, feeling that a correct generic classification must be made later when the sexes are known and have been matched and the mouth parts and genitalia have been dissected.

**MELISSODES (sensu lato) SPILOGNATHUS, new species**

*Female*.—Length about 9.5 mm., black; moderately robust, the base of each mandible with a large triangular yellow mark; face broad, orbits converging below; malar space short, but not linear; clypeus moderately shining, punctured; labrum a broad polished band; flagellum faintly brownish beneath; a shining line above sides of clypeus; sides of face and a band above mandibles with conspicuous grayish hair, cheeks and occiput with the same; vertex shining; thorax at sides and on scutellum with thick grayish hair; mesonotum dull, with thin hair; area of metathorax very short, pointed behind; tegulae dark brown; wings dusky, not reddish, nervures dark; stigma small and narrow; marginal cell with an obtuse end, far away from costa; basal nervure straight; second submarginal cell much narrowed above, receiving first recurrent vein not far from end; outer side of third submarginal cell with a double curve; legs black, with long grayish hair, scopa of hind legs large, full of orange pollen; apex of tarsi reddened; abdomen shining, with apical half of fifth tergite, and apex with dense pale reddish hair; the other tergites with very sparse hair, and no bands.

HONDURAS: Zamorano, December 1 (A. Pelén). It was nesting in the ground.

*Type*.—U.S.N.M. No. 58570.

This species, unique by the light marks on mandibles, but no yellow elsewhere, is certainly not a true *Melissodes*. It is perhaps to be regarded as a distinct genus.

**MELISSODES ALBICAUDUS, new species**

*Male*.—Length about 8.5 mm.; antennae about 5 mm., reaching first abdominal tergite; black, with the clypeus lemon-yellow, the yellow deeply notched at sides, the upper margin nearly straight; labrum yellow; mandibles dark reddish, with a yellowish spot at base; flagellum slender, light reddish beneath; scape entirely black; face and cheeks with white hair; thorax with thin white hair; mesonotum highly polished; tegulae dark reddish; wings dusky hyaline, with small dark stigma and thick dark nervures; marginal cell obtusely pointed, away from costa; second submarginal cell smallest, fairly broad, receiving first recurrent nervure some distance from end; second recurrent nearer to end of third submarginal cell; basal nervure practically interstitial; legs black, the tarsi more or less brownish; hind legs not swollen; abdomen broad, shining and bare at base, but beginning with the apical part of second tergite, covered with appressed white hair; apparently no lateral spines in apical region.

HONDURAS: Zamorano, November (W. P. Cockerell). Also taken in December by Vidales.

*Type*.—U.S.N.M. No. 58571.

Hardly a true *Melissodes*, but I find no better genus for it. It will be known by the small size, rather short antennae, and white hair covering most of abdomen. There is considerable resemblance to *Tetralonia costaricensis* Friese, but the abdomen is different.

Genus **THYGATER** Holmberg

**THYGATER ZAMORANICA**, new species

*Male*.—Length about 11 mm.; differs from *T. albilabris* Cresson by the short hair of thorax; mesonotum with white hair posteriorly, but scutellum black with no yellowish hair at sides; tegula black; wings grayish, not tinged with yellow; abdomen black, the fourth and fifth tergites with some pale hair, but the tergites without testaceous margins.

HONDURAS: Zamorano, October 19 (G. Vidales). Also taken January 1 (Cisneros), January 30 (Adan Rivera), and February 6.

*Type*.—U.S.N.M. No. 58871.

The species will be recognized by the black clypeus and large, white labrum.

*T. rubricata* Smith has the abdomen red.

*T. modesta* Smith has the antennae longer than the body (in our species reaching to base of abdomen); the thorax with pale, fulvous hair above; nervures fuscoferruginous (black in our species).

*T. oribazi* Radoszkowski (apparently intended for *orizabi*) is very much larger (16 mm.).

*T. cockerelli* Crawford has the discs of tergites 1 and 2 largely ferruginous. It is from San José, Costa Rica.

*T. nigravillosa* Crawford, also from San José, Costa Rica, has the clypeus anteriorly narrowly ferruginous (all black in ours); antennae nearly as long as body; apical margins of tergites reddish; apical half of sternites testaceous (all black in ours but with pure white fringes on first four sternites).

**THYGATER COCKERELLI** Crawford

*Female*.—Length about 10 mm.; abdomen very broad, nearly as broad as long; head broad, with black eyes, face and front with thin grayish-white hair; sides of face with distinctly white hair, forming bands along orbits; clypeus convex, largely dull, but polished and more or less keeled in middle; flagellum red, the color bright; mesonotum and scutellum moderately shining, shoulders with red hair; dorsum of thorax with pale reddish hair; cheeks and pleura with white hair; posterior truncation of metathorax shining; tegulae fulvous; wings hyaline, slightly reddish, the apical region fairly dusky; nervures dusky ferruginous; second submarginal cell rather large, square; first recurrent nervure meeting vein bounding submarginal

cell; marginal cell very broadly rounded at apex; legs black, the tarsi rufous apically; pubescence of legs dark gray, whiter on front and middle legs; scopa of hind legs little developed; abdomen appearing gray, with no white bands; tergites 1 to 4 with broad gray bands with a submetallic tint, apex whitish.

HONDURAS: Zamorano, December 22 (Vidales).

**Genus ANTHOPHORA Latreille**

**ANTHOPHORA POPENOEI, new species**

*Female*.—Length about 12.5 mm.; black, the head and thorax without light markings, but with pale and black hair, producing a gray effect; legs without light markings; hind tibiae with clear white hair on outer side, hind basitarsi also with white hair on outer side, but tibiae and basitarsi with dark hair on inner side; abdomen broad, the first four tergites with pale ochereous tegumentary bands, that on the first narrow, the other three broad; tegulae black; wings dusky hyaline; head very broad; eyes and antennae black.

HONDURAS: Nesting in adobe walls at San Francisco finca.

*Type*.—U.S.N.M. No. 58872.

This is possibly related to *A. histrio* Dours, based on a male from Mexico, the face black immaculate. It is similar, in a general way, to *A. walshii* Cresson.

This beautiful bee is dedicated to Dr. Wilson Popenoe, head of the Escuela Agricola Panamericana.

**ANTHOPHORA USTICAUDA Cockerell**

A small species with red hair on abdomen; clypeus with a narrowly interrupted yellow band; body robust; marginal cell very short.

HONDURAS: Zamorano, common. Nesting in adobe walls at San Francisco finca.

GUATEMALA: Antigua (Pelén). Antigua is the type locality.

**ANTHOPHORA USTICAUDA CINERIOR, new variety or subspecies**

*Female*.—The fine tomentum of abdomen, instead of being red, pale reddish gray.

GUATEMALA: Antigua, December (Pelén) (type of variety).

HONDURAS: San Francisco finca, Zamorano Valley, on adobe wall.

*Type*.—U.S.N.M. No. 58873.

This is certainly only a form of *usticauda* Cockerell, but without the characteristic red abdomen.

**ANTHOPHORA FRANCISCANA, new species**

*Female*.—Length about 10 mm.; black, with dull white pubescence, black on vertex; head broad and short; clypeus with a shining keel, and a broad, narrowly interrupted, pale yellowish band just above



the apical margin; labrum with a very large pale yellowish spot, somewhat pyramidal in outline; mandibles with the greater part pale yellowish on outer side; front and sides of face with white hair, but no lateral face marks; antennae entirely black, the flagellum short; mesonotum and scutellum dull, the mesonotum shining in middle of disc; a line of white hair between mesonotum and scutellum; base of metathorax dull, exposed, but surrounded by white hair; tegulae very dark; wings dusky hyaline; legs black; scopa of hind tibiae yellowish, not very large; abdomen broad, cordiform, dullish; first tergite with white hair at base, and the apical margin with a narrow, pure white hair band, interrupted in middle; second segment with a very much broader, but grayer, entire hair band; the following tergites covered with thin grayish hair, denser on apical margin of third tergite, so as to form a poorly defined band; no trace of a dark line down the middle of tergites three and four, which is a conspicuous feature in *A. usticauda*.

HONDURAS: San Francisco finca, Zamorano Valley, November (Vidales).

*Type*.—U.S.N.M. No. 58874.

I thought at first this might be a variety of *A. usticauda* Cockerell, but close comparison shows that this cannot be the case.

**ANTHOPHORA ZAMORANELLA**, new species

*Male*.—Length about 7 mm.; black, with white pubescence, copious and erect on thorax, but scanty on mesonotum; pale yellow markings on head as follows; lower half of clypeus (leaving a triangular black area above), labrum (except two basal spots), large mark on mandibles, and stripe on scape; no supraclypeal mark; eyes green; facial quadrangle higher than broad; mesonotum and scutellum dull, a little shining in certain lights; metathorax mainly dull; tegulae red; wings very clear; nervures dark; second submarginal cell large, contracted above; legs with pale hair; abdomen dull, the hind margins of the tergites with rather narrow dull white hair bands; small spines at sides near apex.

HONDURAS: Zamorano, November 23 (W. P. Cockerell).

*Type*.—U.S.N.M. No. 58875.

Differs from *A. usticauda* Cockerell by the white hair bands of abdomen. *A. franciscana* Cockerell has wings yellowish and abdomen with creamy-white tomentum beyond second tergite.

**ANTHOPHORA PELÉNI**, new species

*Female*.—Length about 12 mm.; robust, black, including face, antenna, and legs; hair of sides of face, pleura, and thorax posteriorly white, of top of head and anterior half of mesonotum gray; head much broader than long; eyes dark brown; clypeus dull; posterior half of mesonotum,

and the scutellum, dull; tegulae dark brown; wings faintly dusky, nervures dark; legs with grayish hair, a bright white patch on apical part of middle tibiae posteriorly; abdomen broad, dull, with very distinct white tegumentary bands on tergites 1 to 4.

HONDURAS: Zamorano (A. Pelén).

*Type*.—U.S.N.M. No. 58876.

Distinguished from related Honduras species by the entirely black tegument of face. It is perhaps related to *A. zamoranella*, known from the male only.

ANTHOPHORA BISPINOSA, new species

*Male*.—Length about 10 mm.; black, head and thorax with dull white hair, without any fulvous tint; eyes greenish; apical half of clypeus (or a little more) light yellow, glistening; scape with a broad light yellow stripe in front, flagellum black; labrum light yellowish, with two round black spots at base; mandibles with a large light yellow mark; sides of labrum with much pure white hair; mesonotum and scutellum dull, no line of white hair between them; front edge of scutellum shining; tegulae black; wings hyaline, slightly dusky; legs black, with white hair; hind tibiae and basitarsi with black hair on inner side, and pure white on outer; abdomen broad, the first five tergites with white hair bands, the first narrow, the others broader; apical plate long and narrow; on each side of apex is a rather small stout spine.

HONDURAS: San Francisco finca, Zamorano Valley, November 10 (Cockerell) (type); October 30 (W. P. Cockerell).

GUATEMALA: Antigua, December (A. Pelén). This differs from the Honduras specimens in having the upper margin of the yellow clypeal band distinctly convex in outline.

*Type*.—U.S.N.M. No. 58877.

Genus CENTRIS Fabricius

CENTRIS (CYANOCENTRIS) ADANI, new species

*Female*.—Length about 15 mm., anterior wing 11; robust, black (including legs), but the first three abdominal tergites dark blue; hair of face, occiput, and thorax light red, but of venter black; supraclypeal area with a dense transverse band of light hair; sides of face with white band, greatly broadened and pointed mesad in middle; clypeus with a reversed T in white, the lateral arms long and concave above; labrum and greater part of mandibles light; antennae black; tegulae light red; wings rather dilute fuliginous; front tibiae with long glistening white hair behind; middle tibiae with gray hair on outer side, their basitarsi with a large brush of intensely black hair; outer side of hind tibiae and tarsi with copious pale reddish hairs; last three tergites of abdomen, and margin of third, covered with pale reddish tomentum;

no light tegumentary mark on abdomen. There is a small light spot on the scape.

HONDURAS: Zamorano, February 9 (Adan Rivera).

*Type*.—U.S.N.M. No. 58878.

Related to the West Indian *C. apicalis* Smith, but with black legs, hair of vertex black, wings fuliginous, and no yellow line on abdomen. There is also a rather close resemblance to *C. maculata* Lepeletier.

CENTRIS (CYANOCENTRIS) POECILA Lepeletier

*Male*.—Length about 12 mm.; clypeus, labrum, base of mandibles, lateral marks, and stripe in front of scape pale yellow; dense hair of thorax above ferruginous, posteriorly and beneath white; wings dusky hyaline; legs black; hind tibiae and basitarsi with black hair, or the long hair posteriorly on apical half of tibiae pale reddish; abdomen with four dark blue tergites, the second with an interrupted yellow band at base; apex of abdomen red. The clypeus has rather short thick lateral black bands, unlike those of *C. wilmattae*.

HONDURAS: Zamorano, February 7 (Adan Rivera).

This agrees with the description of *C. poecila*, which is recorded from Panama, Costa Rica, and Mexico. But it was described from Cuba, and it is possible that Cuban specimens, if compared, would show some difference.

The following male, from Zamorano, January 28 (W. P. Cockerell), was at first considered a distinct species, but it seems to be only a variety, as some examples of *C. poecila* have gray instead of red hair on thorax.

*Male*.—Length about 16 mm.; anterior wing a little over 11 mm.; black, including legs, but the dark parts of abdomen dark blue; face markings creamy white, including the entire front of the short scape, clypeus except a rather narrow band along each lateral margin, not nearly reaching lower margin, long cuneiform lateral marks, the basal end above, all of labrum, and outer side of mandibles; flagellum black; hair of thorax very pale grayish, not at all fulvous, tegulae pale rufotestaceous; wings hyaline, a little dusky; hind tibiae and tarsi with pale reddish hair on outer side, but otherwise with black; tarsi rufescent apically; hind femora very stout, base of first tergite with dull white hair; blue parts of abdomen not hairy, including the first four tergites, the fifth also dark at base; second tergite at base with a narrowly interrupted yellow band broadened laterally; margins of tergites obscurely reddish, apex clear red. Visits *Duranta plumieri*. As between *C. poecila* and *C. versicolor*, the black hair on legs indicates *C. poecila*.

I refer to *C. poecila* a female from Zamorano, November 8 (Geldino Vidales). Length about 15 mm.; similar to *C. adani*, but easily distinguished by the black hair of hind legs and middle tibiae; the fourth

abdominal tergite thinly haired, showing the surface, but its margin red; the black areas on clypeus longer. The first tergite is covered with white hair in front.

**CENTRIS (MELANOCENTRIS) CLYPEATA** Friese

A large, robust, black species, with a white clypeus and labrum in the male.

HONDURAS: Uyaca Mountain, March 23 (Rua Williams). A male, taken at the flowers of a species of *Wigandia* (herbaceous, with stinging hairs on the stem), which is common on the pass between Tegucigalpa and Zamorano.

GUATEMALA: Collected by A. Pelén as follows: Antigua, 3 males, 3 females; Escuintla, 1 female; Río Pensativa, 1 male.

**CENTRIS (MELANOCENTRIS) DURANTAE**, new species

*Male*.—Length about 9.5 mm.; black, with the clypeus, labrum, and large mark on mandibles creamy white, but no lateral marks and the antennae black, without any light marks on scape; the light color of clypeus is broad and short, broadly truncate above; conspicuous black hair at sides of front, but hair of cheeks pure white; a triangular patch of pale hair in supraclypeal region; hair of thorax above light ferruginous, beneath whitish; tegulae ferruginous; wings hyaline; legs with white hair, but long black hair on posterior margin of hind tibiae and tarsi; abdomen shining black, first tergite with white hair; apex, beyond fourth tergite, with pure white hair. This looks like a depauperate *C. ruae*, but it is certainly distinct. The clear wings have paler nervures, and the venation differs. In both, however, there is a supplementary vein crossing the apical part of the first submarginal cell, cutting off a triangular area. The inner side of the second submarginal cell is perfectly straight, not curved as in *C. ruae*.

HONDURAS: Zamorano, February 2, at *Duranta plumieri* (W. P. Cockerell).

*Type*.—U.S.N.M. No. 58879.

In Friese's table this runs to *C. minuta* Mocsary, but it lacks the long tooth on hind basitarsus, and the mandibles are not red on the middle.

**CENTRIS (MELANOCENTRIS) RUAE**, new species

*Female*.—Length 14 mm.; hair of thorax very pale yellowish, of cheeks white; front with light hair, but a little black hair on venter; scape all black, flagellum red beneath; mandibles, labrum, and a broad, narrowly interrupted band on clypeus creamy white, this band not strictly transverse, the lateral parts a little oblique; obscure lateral face marks, not extending above level of antennae; tegulae small, dark brown; wings dusky hyaline; legs black, front legs with white hair posteriorly, middle legs with black hair, but long white hair behind

on basal part of tibiae, hind legs with black hair; abdomen shining black, with glistening pallid hair at extreme apex, and white hair on anterior face of first tergite.

*Male*.—Length 12–13 mm.; clypeus, labrum, mandibles, and linear lateral face marks white, but clypeus with the lower margin black, and the upper part black, the upper margin of the white deeply notched in middle; scape all black; tegulae very dark; first tergite covered with white hair, and the apex of abdomen with long white hair.

HONDURAS: Zamorano. The type is a female taken by Rua Williams (Mrs. L. Williams) on March 30, in the grounds of the Escuela Agrícola Panamericana. Another female was taken on April 8 by Adan Rivera. Two males were taken by W. P. Cockerell and Adan Rivera, January 28.

*Type*.—U.S.N.M. No. 58880.

I was at first inclined to refer this to *C. transversa* Pérez, but it is larger, and the female labrum is entirely white (only the basal half in *transversa*), and the clypeal marks are not strictly transverse, but a little oblique. The white face marks separate it from *C. confinis* Pérez.

CENTRIS (MELANOCENTRIS) PETRAEAE, new species

*Male*.—Length about 10.5 mm.; black, without any metallic tints, clypeus entirely pale yellow; no lateral face marks, scape with a small light spot, flagellum black, labrum and a very large mark on mandibles light yellow; cheeks with long white hair, a large triangular patch of white hair on front; hair of thorax dorsally all pale, slightly yellowish, beneath it is pure white; the mesonotum and scutellum are shining, well punctured; tegulae pale testaceous; wings clear hyaline; inner side of second submarginal cell straight; legs black with black hair on outer side of hind tibiae and tarsi; hind trochanters unarmed; hind femora extremely short, with a prominent tooth beneath near end; hind tibiae unarmed; spurs reddish; abdomen without bands, but with white hair on first tergite, and much white hair at apex.

HONDURAS: Zamorano, January (Rua Williams). It was found on *Petrea volubilis* (Verbenaceae) in cultivation.

*Type*.—U.S.N.M. No. 58881.

In Friese's system it falls nearest to *C. minuta* Moscardi, but it differs in several respects. It is really nearest to *C. ruae* Cockerell, from which it differs chiefly in the entirely pale stigma, lack of lateral face marks, and smaller size.

CENTRIS (MELANOCENTRIS) PETRAEAE RUFOPICTA, new variety or subspecies

*Male*.—Agrees with *C. petraeae* Cockerell, except that the hair of the thorax above is entirely rich ferruginous, and beneath, instead of

being pure white, is dusky reddish; the entirely black hair on hind basitarsi is longer.

HONDURAS: Zamorano, January 11 (Rua Williams).

*Type*.—U.S.N.M. No. 58882.

On account of the bright ferruginous hair on thorax, this looks very different from *C. petraeae*, but it is evidently a form of that species.

**CENTRIS RUFOMACULATA, new species**

*Male*.—Length about 10 mm.; black, with the second and third abdominal tergites broadly red at sides; legs black; antennae black, with the flagellum obscurely brownish beneath; somewhat more than lower half of clypeus pale yellow, the upper margin of the yellow even, margin of clypeus narrowly black; labrum, and mandibles externally except at apex, pale yellowish; hair of thorax entirely pale fulvescent, mesonotum posteriorly exposed and highly polished; tegulae dark; wings faintly dusky, nervures black; abdomen with long white hair at base, and white hair at apex and beneath; hind legs extremely robust, with white hair.

HONDURAS: Zamorano, February 7.

*Type*.—U.S.N.M. No. 58883.

A peculiar species, which I thought might be a melanic variety of a *Rhodocentris* of the *C. lanipes* type.

**CENTRIS (RHODOCENTRIS) LANIPES SUBTARSATA, new subspecies**

HONDURAS: Zamorano. This is the comparatively small and slender species very common at Zamorano. The female has two obliquely placed pale yellow spots on clypeus, well separated from one another, slender lateral face marks, coming to a point above below level of antennae, rather obscure whitish areas at each side of labrum, basal half of mandibles pale yellow (but apical half black); flagellum dusky ferruginous beneath; scape all black; thorax pale fulvous above, white beneath; front and middle legs black, but hind legs red; hair of hind tibiae and tarsi entirely pale reddish.

The male has the clypeus pale yellow except base and apex, very slender lateral marks reaching about level of top of clypeus, labrum all pale, mandible light yellow with the bidentate apex black; flagellum dusky reddish beneath, black at base and apex; scape all black; legs entirely black; hind trochanters spined; hind femora swollen; hair on hind tibiae and basitarsi mostly black or blackish, but yellowish white posteriorly on the tibiae; hair on first tergite of the red abdomen white, at apex of abdomen pale reddish. There is a variable black or dusky cloud on fourth and fifth tergites.

Both sexes were taken in numbers on an adobe wall at San Francisco finca, near Zamorano, November 10. The type is from this locality. A male comes from the beach at San José port, Guatemala, December

22, 1946 (A. Pelén). It has the hair of the thorax whitish, scarcely fulvous, the subapical black spot of abdomen small and obscure, the hind legs with white hair on femora, and posteriorly on tibiae and in part on basitarsi. The legs are black, with the front tarsi red.

*Type*.—U.S.N.M. No. 58884.

The original description of Fabricius, based on a specimen from the West Indies, merely says: "A. thorace cinereo, abdomine rufo, tibiis posticis hirsutissimis." Lepeletier described the female (from Cayenne) as having black legs, but Friese says the legs are red.

The male is certainly very close to the form described by Lepeletier, from an unknown locality, as *C. trigonoides*, yet not quite the same. This has undoubtedly been recorded as *C. tarsata* Smith, which Friese regards as a variety of *C. lanipes*, said to have in both sexes the basitarsi more or less black haired, on the inner side only in female. Smith describes the legs as red. The original *C. tarsata* came from Santarém, Brazil.

On the whole, it appears that we have a recognizable subspecies which may be called *subtarsata*, taking the male for the type.

CENTRIS (RHODOCENTRIS) TRIANGULIFERA, new species

*Female*.—Length about 12.5 mm.; head, thorax, and legs black (except that the hind legs are obscurely reddish), abdomen clear ferruginous, without markings; antennae black, the flagellum obscurely brown beneath; face marks pale yellow, consisting of a pair of very large widely separated triangular marks just above clypeal margin, their outer side incised or concave, a large patch on outer side of mandibles, well separated from lower border, and the labrum whitish, with the upper border and a pair of parallel lines, not reaching lower margin, black; no lateral face marks, but they are simulated by dense white hair; a very large triangular patch of faintly pubescent hair above clypeus, and a patch of the same above each antenna; vertex with black hair, cheeks with white; thorax with pale pubescent hair, short black hairs interspersed on scutellum; under side of thorax with white hair; tegulae dark reddish; wings dusky; hair of legs pale, white on femora, pubescence on tibiae and tarsi, short and black on inner side of hind legs; abdomen clear ferruginous, including first tergite, which has long creamy-white hair.

HONDURAS: Zamorano, January 30 (Adan Rivera).

*Type*.—U.S.N.M. No. 58885.

In Friese's table this species runs best to *C. tarsata*, but it is a very distinct species, recognizable by the face markings.

CENTRIS (RHODOCENTRIS) DENTATA Smith

A rather large species with red abdomen, with no yellow marks on second tergite; clypeus pale yellowish with a pair of black marks on



upper part; legs red, with pale red hair; in the male the inner side of hind tibiae and tarsi with black hair; male with a large tooth on hind femora.

HONDURAS: Zamorano, both sexes, January 23 (Rua Williams), January 29, February 2 (W. P. Cockerell). It visits *Duranta plumieri*.

Described from Brazil, but our insect seems to be the same. It is *C. proxima* Friese, which Ducke refers, apparently correctly, to *C. dentata* Smith. Schwarz has recorded *C. proxima* from Barro Colorado Island, Panama, but Friese does not include it in his Costa Rica list.

**CENTRIS (RHODOCENTRIS) COSTARICENSIS Crawford**

*Female*.—Length about 20 mm., anterior wing nearly 15; black, with the abdomen rich chestnut-red, the first tergite black, with the anterior basin red; clypeus bigibbous above, the apical part concave and the margin elevated; a yellow band across middle of clypeus, very narrowly interrupted in middle; lateral face marks narrow above, extending about to level of antennae; labrum whitish, with a broad triangular black area basally; mandibles largely yellow; flagellum dusky red beneath; cheeks with pure white hair, thorax with grayish hair, on mesonotum extremely short; tegulae black; wings fuliginous, with the apical region broadly paler, the dark part obscurely purple; hair on outer side of hind tibiae and basitarsi pale reddish. The clypeal mark appears as a transverse band, instead of a pair of spots, and there are other small differences from Crawford's description, but I cannot doubt it is the same species. It was originally described by Crawford from Costa Rica as *C. friesei*, but this name was pre-occupied.

HONDURAS: Zamorano, January 29 (W. P. Cockerell).

**CENTRIS (RHODOCENTRIS) ROBUSTA, new species**

*Male*.—Length about 14 mm.; head and thorax black; abdomen rather dark ferruginous, the second tergite at base with a pale yellow band, interrupted in middle, greatly broadened at sides; cream-colored face marks including clypeus, except a very broad black band on each side, a small transverse supraclypeal mark, narrow lateral face marks, entire labrum and outer side of mandibles, scape also light in front; flagellum entirely black; cheeks with white hair, vertex with some dark hairs; thorax above with hair clear ferruginous; tegulae pale reddish; wings strongly dusky; femora black, with the knees more or less red, especially the hind ones, in which the red extends as a broad stripe on inner side to base of femur; front tibiae dark, but their tarsi red; middle and hind tibiae and tarsi dusky reddish, the hind tibiae with a thick brush of black hair on apical part; first abdominal tergite black, apex of abdomen with light red hair.

HONDURAS: Type male taken at Zamorano, February 8 (W. P. Cockerell).

*Type*.—U.S.N.M. No. 58886.

Recognized among the species of *Rhodocentris* by the robust form and the yellow band on second tergite, but actually allied to species that have a dark abdomen. Thus *C. poecila* has a similar band on second tergite. Friese seems to have included this in his *C. inermis*, and *C. inermis gualanensis* Cockerell has the yellow band on second tergite, but it has the face markings bright lemon-yellow and the supraclypeal mark large.

**CENTRIS (RHODOCENTRIS) INERMIS Friese**

*Male*.—A rather large species with red abdomen, resembling *C. robusta*, but with no yellow marks on second tergite. Our specimen has the face marks cream color, and the abdomen without any trace of a blue spot. The mandibles are quadridentate. The lateral black bands of the clypeus are narrower than in *C. robusta*.

HONDURAS: Zamorano, March 6, at *Duranta plumieri* (W. P. Cockerell).

Comparing this with *C. robusta*, I concluded that it was different, but it is not quite typical of *C. inermis*. Certainly *C. inermis*, *gualanensis*, and *robusta* are very closely allied.

The original description of *C. inermis* is: "Nigra, fulvo-hirta, abdomine rufo, facie flavosignata (♀♂), pedibus rufis, fulvo-hirsutis, ♀ scopa fulva, ♂ pedibus inermibus, long. 12–14 mm." Over 50 examples in the Paris Museum from Orizaba, Mexico; also in Brazil.

**CENTRIS INERMIS PALLIDIFRONS, new subspecies**

*Male*.—I have associated with *C. robusta* a series of specimens having the interrupted yellow band on the second tergite, but the hair of the hind tibiae and basitarsi pale red, and the lateral face marks broadly truncate above (as in *inermis*), whereas they are narrower in *robusta*, and produced to a sharp point on orbital margin. This cannot be *C. inermis gualanensis*, as the face marks are very pale yellowish, not "bright lemon yellow," and the supraclypeal mark is a very slender transverse stripe. One specimen has a blue spot at base of second tergite between the yellow marks. The mandibles are tridentate.

HONDURAS: Zamorano, many specimens (W. P. Cockerell, Adan Rivera), Tegucigalpa, February (W. P. Cockerell). Visits *Duranta plumieri*.

*Type*.—U.S.N.M. No. 58887.

Schrottky (1908) treated *C. inermis* as a form of *versicolor* Fabricius.

## Genus EPICHARIS Klug

## EPICHARIS ZAMORANENSIS, new species

*Female*.—Length about 25 mm., anterior wing about 18; robust, black, with black hair on head, thorax and legs, but tergites 4 and 5 with pale fulvous hair, the extreme apex with red; clypeus smooth and shining on upper part, densely punctured on lower, the lateral longitudinal ridges obtuse; antennae black, or faintly reddish at apex, dorsum of thorax practically without hair; wings dark fuliginous, with green iridescence.

HONDURAS: Zamorano, 2,600 feet, November 3 and 5 (Gerardo Cisneros). Apparently common in November, but not found in the following months.

*Type*.—U.S.N.M. No. 58888.

It is a large, robust, very dark insect, superficially resembling a carpenter bee. In Friese's table it runs to *E. schrottkyi*, from Brazil, but that is considerably smaller (18–19 mm.). It also has tergites 3 to 6 gray-haired.

## EPICHARIS CISNEROSI, new species

*Female*.—Length about 22 mm., anterior wing about 14; similar to *E. zamoranensis*, but rather smaller and less robust; the tergites except the first with gray tomentum, rufescent at apex; the wings, though dark fuliginous, not quite so dark, and without the green iridescence; the middle of thorax posteriorly with a patch of light hair; the copious hair of hind tibiae and basitarsi light reddish.

HONDURAS: Zamorano, November 2 (G. Cisneros).

*Type*.—U.S.N.M. No. 58889.

The disc of the mesonotum has thick black hair, which is not the case in *E. zamoranensis*. The first recurrent nervure joins the second submarginal cell far from the base, the second joins the third submarginal almost at the apex.

## EPICHARIS SALAZARI, new species

*Female*.—Length about 16.5 mm.; head and thorax entirely black (including antennae), with black hair, except that on postscutellum and metathorax, which is dull whitish; mandibles with a short, obtuse, inner tooth; labrum elongate, sparsely but distinctly punctured, the basal half with a median keel, the extreme base smooth and shining; clypeus prominent, with a strong keel on each side, the disc shining and somewhat convex; supraclypeal region with an elevated reversed V, the arms, just above the clypeus, enclosing a polished pit; scape very short and stout; tegulae black; wings fuliginous, the

second submarginal cell with the outer side squarely truncate, the inner (basal) one much produced and pointed, the first recurrent nervure joining the second submarginal cell a little beyond the middle; legs black, the middle and front legs with black hair, but the hind tibiae and basitarsi with the copious hair on outer side pale fulvescent; abdomen with the first tergite black, with a broad, interrupted yellow band, poorly defined posteriorly, just above the margin; abdomen beyond the first tergite dusky yellowish, without bands.

EL SALVADOR: Dept. Santa Tecla, February 1947, at white flowers (Mauricio Salazar).

*Type*.—U.S.N.M. No. 58890.

The collector, after whom it is named, has made a large collection of El Salvador butterflies.

Very close to *E. umbracullela umbracullela* Fabricius, but only the first tergite black. It is perhaps no more than a variety.

### Genus MESOPLIA Lepeletier

#### MESOPLIA AZUREA Lepeletier

With shining blue-green abdomen, red legs, first three joints of antennae obscure red, tubercles and tegulae red; face covered with silver-white hairs right across; scutellum obtusely bituberculate; anterior wings with a dark apical spot; first recurrent nervure joining apical corner of second submarginal cell; strongly bifid spur of middle tibiae with two bristles on anterior branch.

GUATEMALA: Antigua, December 19 (A. Pelén).

HONDURAS: Zamorano, January (W. P. Cockerell).

This ought to be identical with *M. azurea guatemalensis* Cockerell, 1912, from Gualan, Guatemala, though the description does not quite agree. Thus the sides of the face are described as covered with silver-white hair, but in the present specimens it extends right across. Since the original *M. azurea* came from the Island of Guadaloupe in the West Indies, one would expect the Central American insect to be somewhat different. It must be added that the Guatemala insect, from Antigua, is appreciably larger than that from Zamorano, and the first recurrent nervure is interstitial whereas in the latter it joins the second submarginal cell near the apex. But a second specimen from Zamorano, February 7 (W. P. Cockerell) has the first recurrent joining the base of the third submarginal cell. In this specimen the hind tibiae are blue-green on the outer side, but this is also true of the Antigua bee.

Friese records *M. azurea* from Costa Rica.

At Zamorano this bee visits *Duranta plumieri*.

Genus *CERATINA* Latreille*CERATINA REGALIMIMUS*, new species

*Female*.—Length about 7 mm.; head, thorax and abdomen bright purple-blue, legs and antennae black; labrum black; middle of apex of clypeus with a rather obscure white spot; mesonotum shining; wings hyaline, faintly dusky; no conspicuous hair, except white hair on hind tibiae. The end of the abdomen resembles that of *C. atrata* H. S. Smith, a black species from British Honduras. The margins of the tergites are not black, as they are in *C. laeta* Spinola.

HONDURAS: Zamorano, January 22 (Adan Rivera).

*Type*.—U.S.N.M. No. 58891.

This struck me at once as resembling *C. regalis* Cockerell from Guatemala. That species was described from the male, but it does not seem possible that this insect, without any green color except on the posterior face of the metathorax and the fifth abdominal tergite, can be its female.

*CERATINA AMABILIS* Cockerell

*Female*.—Length about 12 mm.; face dark green, the clypeus with a broad elongate yellow mark, and a spot at each lateral lower corner (these spots are on the clypeus, not lateral face marks as indicated in H. S. Smith's table); mesonotum and scutellum black, with a little green; base of metathorax brilliant green; pleura blue, contrasting with the green of sides of metathorax; wings dusky; legs black; abdomen, except the first tergite, very rich crimson.

HONDURAS: Zamorano, January (Adan Rivera).

*CERATINA IGNARA* Cresson

*Female*.—Length about 8 mm.; head and thorax dark blue, abdomen green; wings reddish; clypeus with a very large pale spot.

*Male*.—Smaller, with a large hat-shaped light mark on clypeus, and a little mark on each side, away from the eye.

HONDURAS: Zamorano, December, January (W. P. Cockerell, Cisneros). A common species.

In the Annals and Magazine of Natural History, May 1912, I recorded both sexes from Lake Amatitlán, Guatemala (W. P. Cockerell). I described the male, which was unknown to Cresson. Strand, assuming that this male was a different species, named it *C. nara*, but this seems quite unnecessary.

Genus *XYLOCOPA* Latreille*XYLOCOPA LORIPES* Smith

Uyaca Peak, Honduras, above 5,000 feet, March 9 and April 14, males. Black, with the clypeus, supraclypeal mark, lateral face

marks and mark on labrum yellow; scape with an indistinct pale line; mandibles all black, bidentate, eyes very large, approaching on vertex; mesonotum in front with a band of inconspicuous grayish hair; legs as described by Smith, "the posterior tibiae curved, thickened, and deeply notched at their apex"; the notch is a curved exterior excavation and terminates in a short spine. The female was not found.

**XYLOCOPA PELÉNI, new species**

*Male*.—Length about 21 mm., anterior wing about 15; black without any metallic tints; clypeus narrow, supraclypeal mark, lateral face marks (obliquely truncate above at level of supraclypeal area), labrum (but not scape or mandibles) light yellow; antennae entirely black; pubescence black, obscurely grayish on mesonotum; hind tibiae bidentate at apex on outer side; wings dusky brown, subtranslucent, not appreciably metallic; abdomen with no smooth median line; hind margins of tergites 2 to 4 very narrowly red. Resembles *X. loripes*, but smaller, with the eyes hardly approaching above. Supraclypeal mark a narrow band, lateral marks not produced upward along orbit, mandibles obtuse at end, not dentate; hind tibiae without the peculiar form of *X. loripes*. The wings are colored as in *X. loripes*. The posterior margin of the postscutellum is angulate, which is not the case in *X. loripes*. The width of abdomen is about 9.5 mm.

GUATEMALA: San Mateo, December 1946 (A. Pelén).

*Type*.—U.S.N.M. No. 58892.

**XYLOCOPA FIMBRIATA Fabricius (CORNIGER Westwood)**

The female is large and black, superficially like several other species, but easily distinguished by the large curved obtuse horns on the top of the head, laterad of the ocelli. The wings are very dark, shining blue-green, nearly the same as in *X. wilmattae* Cockerell. Three species of *Xylocopa*, superficially alike, were common at Zamorano, principally at flowers of *Crotalaria incana* L., but all the specimens caught were females, and in spite of much searching no males could be found. The other two species are *X. wilmattae* Cockerell and *X. fabricii* Cockerell. One *X. fimbriata* comes from El Salvador (M. Salazar).

**XYLOCOPA FABRICII Cockerell**

*X. morio* Fabricius preoccupied. See Ann. Mag. Nat. Hist., ser. 9, vol. 17, p. 658, 1926. (This was regarded as a subspecies of *X. frontalis*, but it is common at Zamorano, and no *frontalis* was found in Honduras.)

This species is recognizable by the transverse ridges or keels just in front of the lateral ocelli. It has been considered a variety or race

of *X. frontalis* Olivier, which has "the first three or four segments of the abdomen ferruginous, with their apical margins more or less broadly black" (Smith). All the Honduras specimens have the abdomen entirely black, and I am willing to consider *X. fabricii* a distinct species.

Pérez (1901) gives an account of *X. frontalis* Olivier, with which he includes *X. fabricii*. Pérez records the variations in the color of the wings observed by him, as follows:

(1) Wings very brightly colored, greenish bronze, more or less coppery (Chiriquí, Guayaquil, Pará).

(2) Wings greenish blue (Pará).

(3) Wings uniform violet-blue (Chiriquí).

(4) Wings uniform violet-purple (Paraná).

I thought that these must represent a series of closely allied species, but I find that the specimens of *X. fabricii* from Zamorano fall into three series, which, so far as I can see, are structurally identical. It is possible that the males might show structural differences. The three forms are as follows:

(1) Wings shining dark green, the region beyond the cells blackish. This is probably the typical *X. fabricii*.

(2) Wings uniformly rich purple; rather larger than the others. Variety *purpureipennis*, new. The type from Zamorano, February 7. Also taken October 4 (G. Vidales). Type: U.S.N.M. No. 58893.

(3) Wings dark, obscurely purplish, with no green. Variety *obscuripennis*, new. Type from Zamorano, February 7 (A. Pelén). Also December 29. Type: U.S.N.M. No. 58894.

Comparing the types of the two varieties I have named, that of *purpureipennis* is more robust with a conspicuously broader abdomen, but the anterior wings of *obscuripennis* are very long, fully 23 mm.

Mauricio Salazar found at Zamorano a very large black asilid fly, looking just like the black bees such as *X. fabricii*. Dr. Maurice T. James says it is *Mallophora belzebul* Schiner, and it is widely distributed, from Texas to Brazil.

#### XYLOCOPA WILMATTAE Cockerell

This species was described from Guatemala City. I have a couple collected by Amado Pelén at Antigua, Guatemala. It is common at Zamorano, Honduras, flying with the similar species recorded above. We still lack the male.

#### Genus EUGLOSSA Latreille

##### EUGLOSSA CORDATA Linnaeus

Compact, bright emerald-green bees, with greatly modified hind legs; clypeus with a strong median keel; labrum white, with two black



spots; scutellum of female with a small tuft of black hair; second submarginal cell very broad.

HONDURAS: Zamorano, January (Adan Rivera). Only two specimens taken.

**EUGLOSSA SURINAMENSIS** Linnaeus

*Female*.—Large bees, the head, thorax, and legs with black hair; abdomen with first tergite black haired, the others red or reddish, the third tergite with a fine crimson color, the apical tergites not reddish, and with outstanding white hair; sides of face shining dark blue; clypeus bronzy, with a strong median keel; tongue very long, curved, labial palpi with the two apical joints very minute; scutellum strongly produced posteriorly; wings dark, the three submarginal cells subequal in size, first recurrent nervure joining second submarginal far from end, second at end of third submarginal.

HONDURAS: Common at Zamorano. My wife found a nest, with many bees, in the trunk of a guazuma tree (*Guazuma guazuma* L.). This was also taken at Agua Amarilla, December 15.

This species extends from Mexico to Brazil; whether it shows any racial differentiation in this wide range I am not at present able to ascertain. Friese has described a variety from Venezuela.

**Genus EXAERETE** Hoffmannsegg

**EXAERETE BILAMELLOSA**, new species

*Female*.—Length about or nearly 12 mm.; head, thorax, and the thick antennae black, but the scutellum is produced into two long, parallel, lamelliform, shining processes, which are obscurely reddish apically; legs mainly red, but the middle and hind tibiae and tarsi black on outer side; abdomen dark greenish, not hairy; tegulae large, dusky reddish; wings clear, with black markings consisting of a large, quadrate apical spot (its inner side concave) and the apical half of marginal cell; third submarginal cell largest, second somewhat larger than first, very broad; first recurrent nervure joining extreme base of third submarginal cell, second recurrent reaching apex of same cell; hind spurs quite simple, spurs of middle legs broadened, tridentate at end; head smooth, face covered with white hair, clypeus not carinate; thorax densely shining, without erect hairs; hind trochanters with a stout dentiform process. The mouth parts are long. In some specimens the abdomen is purple rather than green.

HONDURAS: Zamorano, November 10 (Vidales); October 30, on adobe wall. Rather common at Zamorano; frequents flowers of *Duranta*.

*Type*.—U.S.N.M. No. 58895.

This is certainly not *E. frontalis* Guérin, which Schwarz records from Barro Colorado Island, Panama, being very much smaller.

It does not appear to be *E. smaragdina* Guérin, which Friese records from Costa Rica as *E. smaragdina* Perty, but I have no material for comparison.

**EXAERETE MELANURA, new species**

*Male*.—Length about 10 mm.; similar in most respects to *E. bilamellosa* Cockerell, but differing thus: Abdomen black, not metallic, except that there is a blue band on fourth tergite; the red lobes on scutellum shorter and broader; face narrower. The end of the abdomen has a pair of widely separated sharp spines. They agree in each having a spine on each side of thorax posteriorly. The lower basal angle of the very wide second submarginal cell is less pointed than in *E. bilamellosa*. I thought this might be the male of *E. bilamellosa*, but it appears too different for this to be the case.

HONDURAS: Zamorano, January 28 (W. P. Cockerell).

*Type*.—U.S.N.M. No. 58896.

Mouré refers these bees to *Ctenioschelus* Romand.

**Genus BOMBUS Latreille**

**BOMBUS FORMOSUS Smith (PULCHER Cresson)**

A magnificent species, with the hairs of head and dorsum of thorax black, yellow on sides of thorax, yellow hair on first three tergites of abdomen, but the sides of the second and third with red hair, the apical part of abdomen with black.

Common on Uyaca Mountain above 5,000 feet, but never seen in the Zamorano Valley.

**BOMBUS VAU-FLAVUS, new species**

*Queen* (type).—Like *B. formosus* Smith, but with no red hair on any part of the body. The hair of the abdomen is yellow on first tergite, yellow except at sides on second, and yellow in middle of third, otherwise black. The thorax is black-haired above, yellow on the sides; the hair of the head is entirely black, the hairs fringing corbiculae are entirely black.

Worker colored like queen. The yellow on third tergite sometimes evanescent.

HONDURAS: The type queen was taken at flowers of a species of Compositae, December 1, 1946, near Agua Amarilla, on the lower part of Uyaca Mountain. Seven workers were taken on Uyaca Mountain, mostly above 5,000 feet.

*Type*.—U.S.N.M. No. 58897.

In Franklin's table of queens, this runs to *B. wilmattae* Cockerell, which is not similar. The worker runs to *B. ephippiatus* Say. One worker has a large tuft of white hair on middle of clypeus, but usually the hair of the head is all black.

This species is so similar to *B. formosus* that we are led to wonder whether it is more than a variety, but its black abdomen with a large yellow V is distinctive and is supported by a considerable series of specimens.

Males from the same locality are probably of this species. They have the first two, or first three, tergites with very light yellow or white hair, but there is no median patch on the tergite beyond, and hence no appearance of a V. The hair of the face is black, or mainly white on the clypeus. The genitalia, so far as exposed, resemble those of *B. montezumae* Cockerell, the volsellae with blunt and quadrate apices. But the apical abdominal tergites lack the ferruginous pile of *B. montezumae*. In Franklin's key the male runs to *B. ephippiatus* Say.

**BOMBUS MATEONIS, new species**

*Male*.—Length about 14 mm.; head with mostly long black hair, white on cheeks, partly white at sides of face and above antennae; malar space in middle not longer than its width at apex; thorax above with long black hair, a little pale anteriorly; pleura with light yellow hair; tegulae black; wings dusky reddish, translucent; legs with black hair, a little pale at base; abdomen with yellow hair on first three tergites, on third black at sides; apical tergites black, but a little pale hair at extreme apex. I was prepared to regard this as a race of *B. ephippiatus* Say, to which it runs in Franklin's tables, but the genitalia are different. The claspers at the end are broadly truncate, slightly notched, and their inner lobe is briefly bidentate at end; the sagittae are strongly curved, and swollen at the base. On the whole, the genitalia are nearest to those of *B. montezumae* Cockerell, yet not identical.

GUATEMALA: San Mateo, from Antigua, several collected by A. Pelén.

*Type*.—U.S.N.M. No. 58898.

**BOMBUS WILMATTAE Cockerell**

GUATEMALA: Río Pensativa, December 18 (A. Pelén). One worker. The type locality is Antigua, Guatemala.

This species has light hair on pleura and on thorax above, except for a black interalar band. The first abdominal tergite has pale hair, the second pale, but black at sides, the third black with a pale patch in middle, the apical part of abdomen black.

**BOMBUS MEXICANUS Cresson (UNIFASCIATUS Smith)**

Black, with a single yellow band on abdomen.

HONDURAS: Zamorano; very abundant, especially fond of the flowers of *Duranta plumieri*. I also have it from Antigua, Guatemala (Pelén).

What appears to be a variety of the male (var. *adani*, new variety) differs by having yellow hair at middle of base of second tergite and entire yellow bands on third and fourth. It was taken at Zamorano, December 17 (Adan Rivera). It runs to *B. mexicanus* in Franklin's table.

*Type*.—U.S.N.M. No. 58899.

Two workers were taken on Uyaca Mountain, February 9, above 5,000 feet (W. P. Cockerell).

#### BOMBUS MEDIUS Cresson

Similar to *B. mexicanus*, with black pubescence and a yellow band on third abdominal tergite, but thorax above yellow in front of and behind the exceedingly broad interalar band.

HONDURAS: Common at Zamorano. A male was taken at Agua Amarilla, December 15. Uyaca Peak, about 6,000 feet, December 14, at flowers of *Salvia lavanduloides* (Vladimir Castellanos).

This was described from Utah, where it does not occur.

Probably this species should be called *B. cajennensis* Fabricius. Franklin says it is impossible to tell from the description whether Fabricius had *B. medius* or *B. incarum* Franklin. Both are found at Boquete, Chiriquí. *B. incarum* was described primarily from Peru, but Franklin saw specimens from British Guiana and Surinam. Franklin cites 10 references to *B. cajennensis*, which he thinks may really represent *B. incarum*. It thus seems impossible to reach a definite decision.

#### BOMBUS NIGER Franklin

Uyaca Mountain, workers only. One specimen has white hair on the penultimate tergite. It was collected February 9 at over 5,000 feet (W. P. Cockerell). I cannot believe it is a distinct species. It may be designated variety *a*.

A single specimen of *B. niger* was taken at Zamorano, December 14 (Cisneros).

#### Genus TRIGONA Jurine

##### TRIGONA (TRIGONA) FULVIVENTRIS Guérin

Mesonotum shining; abdomen red.

HONDURAS: Common at Zamorano.

##### TRIGONA (TRIGONA) SILVESTRIANA Vachal

HONDURAS: Agua Azul, at flowers of *Mimosa*, December 27 (Rua Williams); Zamorano (Pelén); Río Lindo, December 21 (Rua Williams).

A comparatively large species, with very black wings. The specimens of *Trigona* received from the U. S. National Museum, with names at least largely based on the work of Schwarz, are placed in various

aggregate species, the subspecies of which may be very different. I give them under their separate names, not wishing to anticipate the publication of Schwarz's conclusions.

Some of the species, which I cannot identify, I am sending to Schwarz, hoping that he will deal with them later.

**TRIGONA (TRIGONA) CORVINA** Cockerell

HONDURAS: 8 km. west of Dos Aguas (Vidales); Agua Amarilla.

**TRIGONA (TRIGONA) NIGERRIMA** Cresson

HONDURAS: Punta Gorda (Rua Williams); Río Linda (Rua Williams). I had at first taken this for *T. corvina*, but it has conspicuously blacker wings.

**TRIGONA (TETRAGONA) JATY** Smith

HONDURAS: 8 km. west of Dos Aguas (Vidales). A small species, with the narrow abdomen red, with the apical part black; clypeus very pale yellowish. J. Mouré has recently placed this in a new genus, *Tetragonisca* (Rev. Ent., Dec. 1946, p. 438).

**TRIGONA (TETRAGONA) CLAVIPES** Fabricius

HONDURAS: Agua Azul, December 29 (Rua Williams).

This is closely related to the race *dorsalis* Smith, but as compared with specimens from the U. S. National Museum, it has an unusually broad face, and the face markings and scape are white. The narrow abdomen is entirely clear red. I suppose that this is a new subspecies.

**TRIGONA (TETRAGONA) ACAPULCONIS**, new variety (det. H. F. Schwarz)

HONDURAS: Four from 8 km. west of Dos Aguas; two from Zamorano; one from Agua Amarilla; belongs to Mouré's subgenus *Geotrigona*.

**TRIGONA (TETRAGONA) CLAVIPES** var. **DORSALIS** Smith (det. Schwarz)

HONDURAS: Agua Azul (Rua Williams).

**TRIGONA (PLEBEIA) MOSQUITO** var. **FRONTALIS** Friese (det. Schwarz)

HONDURAS: Agua Azul (Rua Williams).

Very small species; clypeus with a broad pale mark in middle.

**TRIGONA (PLEBEIA) MOSQUITO** var. (det. Schwarz)

HONDURAS: Zamorano. "Looks much like a larger edition of *T. m. frontalis* (Schwarz Ms.)."

**TRIGONA (PLEBEIA) MOSQUITO** var. near **DRORYANA** Friese (det. Schwarz)

HONDURAS: Río Linda, on *Cassia*, December 28 (Rua Williams).

**TRIGONA (PLEBEIA) FLAVOCINCTA** Cockerell

HONDURAS: Agua Azul (Rua Williams); Zamorano.

## TRIGONA (PARTAMONA) CUIPIRA Smith

GUATEMALA: Antigua (Pelén). Already recorded from Antigua in Ann. Mag. Nat. Hist., Sept. 1912, p. 314.

HONDURAS: Zamorano, Uyaca Peak, Agua Azul.

## TRIGONA (PARTAMONA) TESTACEA var. ORIZABAENSIS Strand (det. Schwarz)

GUATEMALA: Antigua (Pelén).

HONDURAS: Agua Azul (Rua Williams).

## TRIGONA (PARTAMONA) TESTACEA var. (det. Schwarz)

HONDURAS: Zamorano, Agua Amarilla.

## TRIGONA (SCAURA) LATITARSIS Friese (det. Schwarz)

HONDURAS: Agua Azul, one from Río Linda, December 27 and 28 (both Rua Williams).

*T. argyrea* Cockerell is a synonym.

## TRIGONA (OXYTRIGONA) TESTACEICORNIS var. PERILAMPOIDES Cresson (det. Schwarz)

HONDURAS: Zamorano, common.

## TRIGONA (CEPHALOTRIGONA) ZEXMENIAE Cockerell (det. Schwarz)

HONDURAS: February 12, at Aster, Zamorano (W. P. Cockerell and Adan Rivera).

## Genus MELIPONA Illiger

## MELIPONA BEECHEII Bennett

HONDURAS: Agua Azul, December 27 (Rua Williams); Río Linda, August 28 (Rua Williams). Not rare in the Zamorano Valley. On January 30 it was taken at flowers of *Ceiba* at the San Francisco finca. The specimens have dark heads and possibly deserve to rank as a distinct race.

This is the only *Melipona* we found in Honduras; a strong contrast with the Barro Colorado, Panama, list, which has five.

## Genus APIS Linnaeus

## APIS MELLIFERA LIGUSTICA Spinola

HONDURAS: Zamorano. There are honey bees at the Escuela Agrícola Panamericana, and they appear to be doing well, but as yet they are not numerous in the field and very few examples have been found in collecting.



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A GENERIC REVISION OF THE TREEHOPPERS OF THE  
TRIBE CERESINI IN AMERICA NORTH OF MEXICO,<sup>1</sup>  
BASED ON A STUDY OF THE MALE GENITALIA

By JOHN S. CALDWELL

THE homopterous tribe Ceresini [original spelling Cerasini] Goding (1892, p. 256) contains those species of tree hoppers within the subfamily Similiinae that have the elytra free, with the clavus not covered by the pronotum. Fowler (1895, p. 87) has stated that "the Cerasini might, with reason, be further subdivided into three [tribes], Cyphoniini, Cerasini, and Acutalini." The Nearctic genera<sup>2</sup> form two natural groups on the basis of internal and external characters, thereby substantiating two of the three subdivisions suggested by Fowler; however, without a comprehensive study of Neotropical material, especially of Cyphoniini, it is believed wiser at this time to let Ceresini stand as one unit.

The genera have been accepted as morphologically distinct by previous workers, with the exception of *Ceresa* and *Stictocephala*, which have been distinguished from each other by the presence or absence of suprahumeral horns. The fallacy of using this character for separating the two genera has been the subject of considerable comment. Fowler (1895, pp. 87, 108) was the first to suggest separating *Ceresa* from *Stictocephala* by using characters of the male genitalia and proposed that species possessing an aedeagus with a much widened apex and having the styles short and obtuse be placed in the latter genus; however, *cornuta* Fowler (1895, p. 110) apparently

<sup>1</sup> The geographic limitation set forth here is not strictly followed, since much of the fauna of Mexico and Central America has been included when the material was available.

<sup>2</sup> For convenience in this discussion the term "Nearctic" is applied to any genus represented in the Nearctic region even though the majority of the species of the genus may be Neotropical.



is the only species in the "Biologia" whose generic position has been determined by this method.

Subsequently it has been generally agreed that the characters of the male genitalia may be used successfully to distinguish *Ceresa* and *Stictocephala*, but there are no practical applications of this principle in any published works. Van Duzee (1908, pp. 41-42) objected to the use of the characters of the male genitalia for distinguishing the genera but admitted that the present basis of separation is "purely artificial" and that "the two genera run into one another by insensible gradations," while Lawson (1922, p. 40) has suggested that "the genus *Stictocephala* should be divided, for the genitalia of *S. festina* and *S. lutea* cannot possibly belong to members of the same genus." Thus the idea has been developed that the division between *Ceresa* and *Stictocephala* and the composition of *Stictocephala* itself, as they now stand, are artificial and should be modified to form a more natural arrangement. The genus *Stictolobus* Metcalf (1916) is of comparative recent erection; therefore, it escaped comment in the earlier publications, and it was not represented in the fauna treated by Lawson.

In extending the investigation of correlation of genital and pronotal characters to include all the Nearctic Ceresini it has been found that the internal male genitalia of the species of *Ceresa*, *Stictocephala*, and *Stictolobus* form natural or similar groups not coincident with the divisions based upon pronotal characters. It is apparent that in this group of Ceresini a condition has been developed that has resulted in much confusion between superficial and basic relationships, and it would seem that our present interpretations of generic and specific relationships have been greatly influenced by the anterior pronotal characters (e. g., the metopidium and suprahumeral), which in the majority of cases probably have little real phylogenetic significance.

Funkhouser (1917, p. 314) has expressed his belief that the anterior pronotal characters are primarily specific in value and, in reviewing the possibility of using genital characters for classification of the Membracidae in general, states (p. 353):

Occasional attempts have been made to use the internal male genitalia for systematic purposes, but with little success. It is not unreasonable to believe, however, that these structures, which have proved of so much value in other groups of insects, should be equally distinctive in the Membracidae if the characters are patiently diagnosed for a large number of genera. It may naturally be supposed that sexual organs undergo less change when insects are forced into new conditions and environments than do motor or protective structures, and, being less plastic, would preserve their characters and readily yield themselves to generic classifications. A tentative study has seemed to show that this is indeed the case. The organs have become modified in form and have developed various types of claspers, styles, and prongs, but the necessity of retaining the function of the organs has kept these modifications within bounds.

While it may be highly improbable that this logic is applicable to all problems involving conflicting interpretations of pronotal and phallic characters or that the problems themselves have so simple a solution, at the same time this line of reasoning must form at least a part of the basic concept for evaluating the actual phylogeny because without it there is no rational approach to the correlation of the apparently conflicting evidence presented by phallic and pronotal characters. It must have been this conflicting evidence that prompted Buckton (1903, p. 18) to state, "The diversity of form and aptitude for variation appear in these organs [sexual organs] to be an embarrassment rather than an assistance in classification."

In this attempt to understand the probable relationships within the Ceresini it is realized that the evaluation and interpretation of phallic characters are not absolutely correct, but it is believed that the proposed arrangement is much more natural than the present system even though it is a radical departure from that system and is for the most part based upon only one sex. It is also realized that a restricted fauna as a basis for a generic revision is very inadequate; therefore, insofar as possible, the genotypes of Neotropical genera and as many other species as were available have been examined in an effort to eliminate errors. As a source of authentic material the majority of species examined in this work were determined by Dr. W. D. Funkhouser supplemented by specimens determined by the late Dr. E. D. Ball and Dr. F. W. Goding. Dr. W. E. China, of the British Museum, has kindly furnished illustrations of *Thelia lutea* Walker and supplied information concerning the type specimen. He has also stated that the type specimen of *Membracis vitulus* Fabricius originally described from the Drury collection is not in the British Museum.

Dr. E. C. Van Dyke has kindly supplied specimens from the California Academy of Sciences collection described and arranged by the late E. P. Van Duzee, including a cotype male of *Ceresa palmeri* Van Duzee labeled "Quinzelt; P. Q.; W. J. Palmer, 8-19-07." At the suggestion of Dr. Van Dyke this specimen is hereby designated the lectotype of *Ceresa palmeri* Van Duzee. M. A. Yothers has furnished all the correspondence and specimens that have been accumulated in his work on the treehoppers. Dr. C. C. Plummer has read the manuscript in its entirety and has offered helpful criticism and suggestions. To all these men, and to others within the Bureau of Entomology and Plant Quarantine who have given freely of their time for discussion and suggestions, the writer is indebted for assistance in preparation of this paper.

## MORPHOLOGIC AND DIAGNOSTIC NOTES

The terminology used by Funkhouser (1917, pp. 352-363) in his discussion of the male genitalia has been followed in this paper, and no attempt has been made to enter into a detailed discussion of the morphology; however, the characters that have been considered as criteria for generic interpretation are outlined. The greatest consideration has been given to the form and structure of the aedeagus, which is fundamentally a U-shaped organ with the functional orifice on the posterior arm. Except *Acutalis*, *Micrutalis*, and *Parantonae*, there are four basic types of aedeagi represented in the Nearctic Ceresini: The U-shaped type with the posterior arm simple and slender; the U-shaped type in which the two arms are subequal in size with the posterior arm bearing an apical flap or otherwise variously modified; the trifurcate type, which has a bifurcate process at the base of the posterior arm; and the single arm type with the anterior arm greatly suppressed or not evident. These basic types may be subdivided into smaller groups according to less apparent morphological differences. It is believed that these basic types of aedeagi, and in most cases the subdivisions, possess fundamental characters for generic concept.

The styles fall into two groups: one in which the apices of the styles are vestigial and the other in which the apices are normally developed. The normally developed styles may be further divided into smaller groups on the basis of shape, form, and direction of projection. In most instances these groups are distinct and are associated with a definite type of aedeagus and, therefore, are of assistance in generic evaluation. The length of the teeth on the lateral valves is usually inversely proportionate to the development of the styles in that vestigial styles are accompanied by greatly developed teeth on the lateral valves and vestigial teeth are usually indicative of greatly developed styles. Since the differences in the form and the location of the teeth on the lateral valves can usually be associated with certain types of styles and aedeagi they are of generic value.

The genera *Acutalis*, *Micrutalis*, and *Parantonae* form a natural group apart from the other Nearctic Ceresini in that the apices of their styles are strongly recurved and project somewhat laterally toward the outside of the genital cavity, and their aedeagi are short and thickened. These three genera seem to represent natural divisions in that the phallic characters can be classified into three types that agree with the present generic concepts based upon external characters.

Almost all of the species cited in the generic review have been studied, their genitalia have been illustrated, and in genera primarily limited in distribution to the United States the species have been

briefly diagnosed. The synonymy, which is often extensive, has not been included because much of it may be found by referring to the "Catalogue" by Funkhouser (1927, pp. 179-233). It has been found in studying the genitalia of the various species of Membracidae that there is considerable variation within each species, especially if contrasted with other species of auchenorrhynchous Homoptera; however, this variation is within definite limits, and the forms within the membracids are for the most part morphologically distinct and readily diagnosed. The form and size of the apical portion of the styles and the form and location of the teeth on the lateral valves are perhaps the most significant specific characters. The aedeagus is usually slightly different in each form, and in some groups it is sufficiently distinct for specific placement.

Several new forms are added to the list of described species. Where there is very little suggestion of close relationship to established species the new forms are considered to represent species. When the new forms are somewhat similar to established species they are treated as varieties when the two occur in the same territory, or if their ranges do not overlap or coincide then the new forms are believed to represent subspecies. Much more biological data are needed to ascertain the true nature of the forms in subspecific and varietal categories. The only genera in which color varieties are believed to be valid are *Acutalis* and *Micrutalis* where in most cases the color patterns are definite and the distribution of the varieties is such that there must be some correlation between the two.

#### GENERALIZATIONS ON PHYLOGENY

In order to have a starting point upon which to base the interpretations of the probable phylogeny of the Ceresini it is necessary to find the type of genitalia in the other Membracidae, especially in the Smiliinae, from which the more specialized genitalia of the Ceresini could have evolved. Not the most primitive in form for the Membracidae as a whole, but nevertheless the most common throughout the Nearctic genera, is that type of genitalia in which the lateral valves are present and unarmed, the aedeagus is a U-shaped organ, and the apices of the styles are strongly recurved dorsally and laterally. This type of genitalia is assumed to be the generalized type for the Smiliinae because it is the most simple and the most common, and it affords a convenient base from which it is possible to trace the deviations that occur in the Ceresini.

If the styles function as clasping organs, and this has been observed to be the case in several species studied by Funkhouser (1917, p. 362), then it may be reasonable to assume that any modification in their morphology affecting the efficiency of their function must have a

direct influence on the morphology of other organs or structures involved in copulation. It is probable that as the styles became less efficient for clasping their function was assumed in part or in full by some other organs or structures with a resulting modification of these parts, or it may be possible that other aids to clasping arose first and then the styles became less efficient or modified. Teeth on the lateral valves, and the spines or processes and other modifications of the aedeagus, are interpreted as functioning as clasping structures. The evidence supporting the aforementioned theories may be observed in the generic series of Ceresini where the arbitrarily generalized style unrolls, becomes flattened, shrinks in size, and then vanishes as the associated structures have become adapted for clasping. Since this specialized condition has not been observed in other genera of Nearctic Membracidae it is believed that the Ceresini, especially those with the veins of the corium united at the base, form a distinct and adventitious branch of the Membracidae. It is not known just where the specialization of the genitalia begins in this group nor is it known whether it is of singular or multiple origin; however, the more generalized type of genitalia occurs in *Parantoniae*, *Microtalis*, and *Acutalis*. *Parantoniae* is perhaps more closely related to the Neotropical genera *Poppea* Stål and *Antoniae* Stål than to any Nearctic genera although it may be distantly related to *Acutalis*. *Microtalis* superficially resembles *Acutalis*, but the styles and aedeagi of the two are not similar and the relationship cannot be very close. I believe that *Microtalis* is more closely related to the Neotropical genus *Brachytalis* Metcalf and Bruner, which in its present concept includes some species with minute teeth on the lateral valves. Some species of *Melusina* Stål and *Centrogonia* Stål, both Neotropical, have teeth on the lateral valves and the genera are distantly related to *Stictocephala* and to *Ceresa*, a genus restricted to the Neotropics. *Stictocephala* and *Tortistilis* both have similar aedeagi but are differentiated by the styles which are apically acute in the former and apically truncate or convergent in the latter. *Anisostylus* seems to be an isolated group suggestive of *Tortistilus* but is probably more closely related to *Spissistilus*. *Spissistilus* may well be the progenitor of *Vestistilus*, *Stictolobus*, and *Trichaetipyga*, as here the styles have definitely begun to shorten and in the last three genera the styles are more or less vestigial. *Vestistilus* is probably more closely related to *Spissistilus* than the other genera since the aedeagus is not too dissimilar while *Trichaetipyga* is probably further removed because the aedeagus in this genus is highly modified. *Stictolobus* seems to be a separate offshoot from *Spissistilus* not very closely related to *Vestistilus* or *Trichaetipyga*.

KEY TO THE MALES OF THE NEARCTIC GENERA OF CERESINI

1. Lateral valves and pygofer without teeth; apices of styles strongly recurved, divergent..... 2  
Lateral valves or pygofer with teeth; apices of styles vestigial or normal; if normal in length then apices are straight, convergent, or curved dorsally.. 4
2. Styles with apices obliquely truncate or barbed..... **Micrutalis** Fowler  
Styles with apices acuminate..... 3
3. Aedeagus with minute spines on anterior surface of posterior arm present for full length; lateral valves without tubercles..... **Acutalis** Fairmaire  
Aedeagus with large spines at apex of posterior arm on anterior surface; lateral valves with large rounded tubercles..... **Parantonae** Fowler
4. Aedeagus U-shaped, anterior and posterior arms subequal in length..... 5  
Aedeagus trifurcate or consisting of a single arm..... 10
5. Styles vestigial on apical half; teeth of lateral valves as long or longer than length of valves..... **Vestistilus**, new genus  
Styles normal on apical half; teeth of lateral valves shorter than length of valves, usually much so..... 6
6. Each lateral valve with two teeth, more dorsally placed tooth smaller than more ventrally placed tooth with surface of valve concave between; aedeagus much shorter than valves or styles, posterior arm finely dentate on anterior surface..... **Ceresa** Amyot and Serville  
Each lateral valve with one tooth; aedeagus as long as valves, posterior arm not dentate on anterior surface..... 7
7. Aedeagus with posterior arm simple, broader than anterior arm; functional orifice extending full length of posterior arm; styles usually strongly curved dorsally..... **Anisostylus**, new genus  
Aedeagus with posterior arm more slender than anterior; if arms are subequal in size then an apical flap or modification thereof is present on posterior arm..... 8
8. Styles broad, flat, slightly lunate on apical half; apices obtuse; posterior arm of aedeagus with apical flap or modification thereof.. **Spissistilus**, new genus  
Styles long and acuminate apically; or S-shaped with truncate apices, or long with apices convergent..... 9
9. Styles long and acuminate apically; teeth on lateral valves as long or slightly longer than width of valves..... **Stictocephala** Stål  
Styles S-shaped with truncate apices, or long with apices convergent; teeth on lateral valves shorter than width of valves..... **Tortistilus**, new genus
10. Aedeagus appearing as a single tube or with anterior arm greatly suppressed..... **Stictolobus** Metcalf  
Aedeagus trifurcate; ventroposterior arm bifid.... **Trichaetipyga**, new genus

Genus ACUTALIS Fairmaire

PLATE 18, FIGURE 3

*Acutalis* FAIRMAIRE, 1846, p. 496.

Similar to *Micrutalis* Fowler in general form but differing from that genus in that the venation of the elytra is distinct and five apical cells are present instead of three or four. The styles of the male somewhat resemble those in *Anisostylus*, new genus, but the lateral valves are unarmed and the aedeagus is of a more compact type. In general, the entire genitalia suggest close relationship to *Euritia* Stål and *Thrasymedes* Kirkaldy, which are tropical genera.



Pronotum low; lateral extensions knoblike; metopidium smooth; humerals slightly produced, obtuse; posterior process elongate, acute apically. Elytra with five apical cells; venation distinct, veins on corium separated at base. Lateral valves without teeth, usually narrow, elongate. Sternal plate with deep, broad, apical notch. Apices of styles acute, strongly recurved dorsally and laterally. Aedeagus short, with posterior arm much larger than anterior, with its anterior surface minutely dentate.

Type of the genus, *Acutalis fusconervosa* Fairmaire (1846, p. 498), a tropical species described from Colombia and occurring northward into Mexico. In the North American fauna only two species are structurally distinct and the other forms are believed to be color variations. The North American forms are listed:

*fusconervosa* Fairmaire, 1846

*tartarea* (Say, 1830)

var. *inornata* Ball, 1905

var. *nigrinervis* Fowler, 1895

var. *semicrema* (Say, 1830)

#### Genus MICRUTALIS Fowler

##### PLATE 18, FIGURE 2

*Micrutalis* FOWLER, 1895, p. 116.

Probably distantly related to *Acutalis* Fairmaire but more closely related to *Brachytalis* Metcalf and Bruner. Distinguished from either genus by the obscure venation of the elytra and the angular form of the styles and aedeagus.

Pronotum low; lateral extensions thin, platelike; metopidium smooth, very broadly rounded; suprahumeral smooth; humerals produced, obtuse; posterior process short, not constricted before obtuse apex. Elytra with three or four apical cells; venation obscure, veins on corium separated at base. Lateral valves almost as large or larger than pygofer, without teeth. Sternal plate deeply slit apically. Apices of styles abruptly directed dorsad; barbed on anterior margin. Aedeagus with arms subequal in size, angulate in lateral aspect; posterior arm with anterior and posterior margins parallel, posterior margin perpendicular to ventral margin, in lateral aspect.

Type of the genus, *Tragopa ephippium* Burmeister (1836, p. 191), a Neotropical species. Most of the species in this genus are small and lack morphological characters that may be used to distinguish one from another; however, in a few forms color characters seem to be consistent. These forms have been given varietal rank. The forms occurring within the United States are listed below:

*calva* (Say, 1830)

var. *occidentalis* Goding, 1894

var. *parva* Goding, 1894

*dorsalis* (Fitch, 1851)



Genus *PARANTONAE* Fowler

PLATE 18, FIGURE 1

*Parantonae* FOWLER, 1895, p. 101.

Easily separated from the other Nearctic genera by the greatly inflated sacs on the pronotum. Closely related to the Neotropical genera *Antonae* Stål and *Poppea* Stål from which it differs by the enlarged transversely globose sac located posteriorly on the pronotum followed by a single slender process.

Type of the genus, *Parantonae dipteroides* Fowler (1895, p. 102), a species from Guatemala. In this work only the male of *hispidus* Van Duzee, a species found in Arizona and California, has been available for study, and so it is impossible to formulate an accurate picture of the type of male genitalia characteristic for *Parantonae*. In general, however, the apices of the styles are acute, recurved, and strongly divergent. The posterior arm of the aedeagus is short and thick and bears rather stout spines on the anterior margin near the apex. Each lateral valve bears a prominent globose bump and this character, if not specific in nature, will serve to separate this genus from its closest relatives. All the known forms that have been described in this genus are listed:

*binodosa* Goding, 1926*dipteroides* Fowler, 1895*hispidus* Van Duzee, 1914*ornata* Plummer, 1935Genus *CERESA* Amyot and Serville

PLATE 18, FIGURE 5

*Ceresa* AMYOT and SERVILLE, 1843, p. 539.

As far as known this genus is not represented in the Nearctic fauna, although it comes as far north as Central America and southern Mexico. Because this genus has been differentiated from related genera, notably *Stictocephala* Stål, by the single criterion of the presence of suprahumeral horns it has been erroneously assumed that our common North American species of *Stictocephala* belong in this genus. The genus as here redefined, with greater weight placed upon the value of genital characters, is not represented in the Nearctic and the great majority of our North American *Ceresa* belong in *Stictocephala* while most of the South American forms will remain in *Ceresa*.

The type species, *Membracis vitulus* Fabricius (1775, p. 677), originally described from South American material in the Drury collection, has not been examined and the interpretation of this species has been based on Brazilian material answering in so far as possible to the descriptions given by Fabricius, Fairmaire, Stål, and Fowler.

In the collection of the U. S. National Museum are specimens determined by Funkhouser and Goding as *vitulus* Fabricius that fit the meager definition of that species. A plesiotype male has been selected from this material upon which is based the specific concept of *vitulus* and the generic concept of *Ceresa*. The generic concept of *Ceresa* has been further fortified by a study of other forms congeneric with *vitulus*.

Metopidium vertical, rounding posteriorly, slightly transversely rounded, very broad. Suprahumeral greatly developed into long, acute horns, somewhat curved posteriorly. Pronotum greatly narrowed behind humeral angles; sides almost vertical; dorsal ridge very acute, posterior process elongate, acute.

Sternal plate narrowed in apical half. Lateral valves with apical portions produced into small acute teeth in addition to elongate lateral teeth. Lateral teeth arising near centers of anterior margins of valves, curved somewhat dorsally. Styles thickened, usually elongate; apices variously modified according to the species, usually suddenly narrowed near apices. Connective between styles and aedeagus almost as long as aedeagus. ("Style-aedeagus connective" of Lawson, 1922, p. 39.) Aedeagus with arms subequal in length; posterior arm more slender than anterior; anterior surface of posterior arm finely and densely dentate; opening very broad, extending almost for full length of posterior arm.

#### CERESA VITULUS (Fabricius)

*Membracis vitulus* FABRICIUS, 1775, p. 677.

Approximately 10 mm. in total length; width across suprahumeral horns 6 mm. White, arched, lateral stripes present on sides of pronotum. (These stripes are more prominent on some specimens than others.) Elytra yellowish-tinted. Styles of male with suddenly constricted apices, heavily pilose, strongly convergent.

Male plesiotype from Pará, Brazil.

#### Genus STICTOCEPHALA Stål

##### PLATE 18, FIGURE 4

*Stictocephala* STÅL, 1869, p. 24.

Resembling *Ceresa* in general appearance but apparently not closely related. Similar to *Tortistilus*, new genus, in the form of the aedeagus but lacking the flattened convergent styles of that genus and possessing a pronotum that is much lower anteriorly.

Suprahumeral either smooth or developed into horns. Metopidium sloped or curved posteriorly. Male styles in apical half round or oval in cross section, sometimes slightly curved dorsally, acuminate apically. Aedeagus with functional orifice long, narrow, subapical;

apex of posterior arm acuminate in lateral aspect, appearing flattened in caudal aspect.

Type of the genus, *Thelia lutea* Walker (1851), from North America. Because the Walker specimens are cotype material it is desirable to designate one specimen as type. Funkhouser (1923, p. 113), in referring to the figure of *lutea* drawn by Knight, made the following statement: "We should consider the form as figured by Mr. Knight as typical." It is believed that this statement cannot be rigidly construed as type fixation, and furthermore, it is uncertain which of Walker's specimens was figured; however, according to W. E. China,<sup>3</sup> it is believed to be specimen "a" (Walker, 1851, p. 560), which is a female. I believe the specimen figured by Knight to be *festina* (Say), because a proportionate drawing of *festina* superimposed over the illustration by Knight is too nearly perfect for the two not to be the same species. If this belief is true then Walker's original description of *lutea* cannot be based on specimen "a," as the colors mentioned in the description do not occur in *festina*. W. E. China has stated further that specimen "c," a male, bears a type label (labeled before his time) and is conspecific with specimen "b," which is also a male. In order to validate the labeled type of the Walker material I hereby designate specimen "c" as lectotype male of *Thelia lutea* Walker.

With few exceptions the majority of the species occurring in the Nearctic that were included in *Ceresa* will now be included in *Stictocephala*. As far as known the genus is limited in its distribution to the Nearctic region of North America and undoubtedly occurs in northern Mexico and in the higher elevations farther south, but there are no records of any species from Mexico. The life histories and partial biologies worked out for a few forms would indicate that oviposition occurs on woody plants and that the development of the immatures occurs on succulent herbaceous vegetation.

*Stictocephala* is closely related to *Tortistilus* through *lutea*, *substriata*, and *diminuta* which resemble the forms of *Tortistilus* that occur on cypress. *S. abnormalis* and *S. curvata* also have styles that are suggestive of those possessed by species of *Tortistilus*.

In general, the male genitalia of the species appear to be well defined and subject to little variation. The style type associated with the species of this genus is simplified and tubular in form, and the differences between many forms are not outstanding; however, by making use of the prominent characters displayed by the body in general and the thorax, such as color and development of the supra-humeral, supplemented by characters found in the genitalia, the forms can be differentiated without too much difficulty.

*S. diceros* and *S. albescens* are differentiated from the other forms

<sup>3</sup> In correspondence.

by color; both are brown with *dicerus* displaying two light bands on the pronotum and *albescens* only one band. *S. basalis* is the only species with the entire venter jet black, and sometimes the entire body is more or less blackened. *S. lutea*, *substriata*, and *diminuta* are the only forms without suprahumeral horns. *S. substriata* has the lateral valves produced dorsally beyond the pygofer and the teeth on the valves are very thick, while *lutea* and *diminuta* have normal lateral valves with slender teeth. The styles in *lutea* are smooth beneath apically while those of *diminuta* are serrate beneath. *S. brevicornis* and *curvata* have the suprahumeral horns very minute and the metopidium is evenly convex in dorsal aspect. The styles in *brevicornis* are evenly curved for full length, while those of *curvata* are abruptly curved in the apical fourth. The teeth on the lateral valves are broadly rounded apically in *brevicornis* and apically acute in *curvata*. *S. palmeri* is characterized by the presence of a basal ring on the posterior arm of the aedeagus. *S. tauriniformis* is the only species with the teeth of the lateral valves very suddenly narrowed and stylete in the apical third. *S. militaris* and *abnorma* are unusual in the elongate form of the genitalia; the sternal plate is as long or longer than the rest of the abdomen in either species. The styles in *abnorma* are strongly curved in the apical fourth, while in *militaris* they are straight throughout. *S. brevis*, *brevitylus*, and *stimulea* have in common a strongly convex metopidium with the suprahumeral horns continuing the line of the metopidial curve and projecting somewhat posteriorly. In *brevis* the teeth of the lateral valves are abruptly bent inward in the apical third while the last two species have straight teeth. *S. stimulea* is a larger species than *brevitylus* and has the functional orifice not reaching to the apex of the aedeagus while *brevitylus* has a functional orifice extending to the apex of the aedeagus. *S. bubalus* is the largest and most robust species of the genus with a very broad metopidium. Often a small dark spot is present on the pronotum near the apex of the posterior process that will assist in distinguishing *bubalus* from the other species.

*S. taurina* resembles *tauriniformis* in that both forms have a very low pronotum with the suprahumeral horns relatively short, acute, and slightly recurved apically; however, the teeth of the lateral valves in *taurina* are gradually acute apically and are not suddenly narrowed as in *tauriniformis*. In the present concept, *taurina* seems to be a complex of at least two variable forms between which this writer is unable to distinguish. If *taurina* represents one biological unit, then it is subject to great variation throughout its extensive range. *S. taurina*, as characterized by Fitch's type, has the teeth of the lateral valves very acute apically, the styles evenly curved in lateral aspect and convergent in the apical third in ventral aspect. The extreme of the other

form has the teeth of the lateral valves rounded or obtuse apically, the styles with their apices deflected ventrally in lateral aspect and evenly convergently curved in ventral aspect. This latter form is slightly larger than typical *taurina*, but all the characters that might serve to differentiate the two forms are gradational in an extensive series of specimens. It is well to note here that the specimen in the U. S. National Museum, labeled type of *illinoiensis*, is conspecific with typical *taurina*; therefore, *illinoiensis* is a synonym of *taurina* and is not a synonym of *constans* (Walker) as believed by Van Duzee; however, there is a specimen labeled "*illinoiensis* n. sp." in the U. S. National Museum collection that is conspecific with *constans*.

The interpretation of *borealis* is based on specimens determined by Funkhouser that fit the meager description given by Fairmaire. It is a small, short-horned species occurring across northern United States from the Atlantic to the Pacific coast and as far south as Arizona. The styles are slender and deflected ventrally at their apices, and the posterior arm of the aedeagus is more slender in proportion to the size of the entire insect than in other species.

STICTOCEPHALA CURVATA, new species

PLATE 20

Length, male 8.8 mm., female 9.6 mm.; width across horns approximating 3.8 mm. in either sex. General color of dried specimens orange-yellow, suprahumeral horns tipped with polished black.

Thorax highly arched; metopidium widening to suprahumeral, roundedly curved from suprahumeral to dorsal crest; suprahumeral produced into minute, obtuse horns; posterior process continuing curve of crest, narrowed from ventral margins well before apex.

Male with teeth of lateral valves slender, acute. Sternal plate deep basally, apex with very small but sharp V-shaped notch. Styles concave basally in lateral aspect, strongly convergent apically in ventral aspect; apices flattened, broadly rounded. Posterior arm of aedeagus suddenly narrowed apically in lateral aspect; lateral membranes on either side somewhat serrate; a small hoodlike process present subapically on anterior surface formed by union of lateral membranes.

Last ventral segment of female with broad notch in center of posterior margin reaching half the depth of the segment; sides of notch broadly sinuate.

Holotype male (U.S. N. M. No. 57640), three male paratypes, female allotype, and four female paratypes from "Carns," Nebr., July 1902, on *Symphoricarpos* (Pierce); and one male paratype, "C. Mc.," July.

Similar in appearance to *brevicornis* (Fitch) but with much smaller suprahumeral and different genitalia.

## STICTOCEPHALA ABNORMA, new species

## PLATE 20

Superficially resembling *borealis* (Fairmaire) but with the pronotum more arched. Closely related to *militaris* (Gibson and Wells) in structure of the genitalia but differing from that species by the more acute teeth on the lateral valves and by the caliperlike styles.

Length, male 7.2 mm., female 7.5 mm.; width across horns, male 3.8 mm., female 4.2 mm. General color of dried material yellow washed with green; sides of pronotum spotted with white.

Pronotum highly arched; metopidium flat from horns to dorsal crest; humerals little produced; suprahumeral produced into blunt horns; posterior process gradually narrowed, acute apically.

Male with lateral valves elongate, narrow; teeth arising from upper fourth, as long as width of valves, acute apically. Sternal plate narrow, elongate, acute V-shaped notch in apical margin. Styles almost three times as long as aedeagus, caliperlike in apical third in ventral aspect, S-shaped in lateral aspect. Connective from styles to aedeagus as long as aedeagus.

Last ventral segment of female with broad V-shaped notch in center of posterior margin.

Male holotype (U.S.N.M. No. 57641), three male paratypes, female allotype, and one female paratype from Concan, Tex., June 4, 1933 (Oman); one male and one female paratype from Brownwood, Tex., May 29, 1941 (Christenson).

## STICTOCEPHALA TAURINIFORMIS, new species

## PLATE 21

Resembling *taurina* (Fitch) but with lower and flatter pronotum. Somewhat similar to *palmeri* (Van Duzee) in general appearance but with longer horns; differing from any related species by the suddenly narrowed apices of the teeth on the lateral valves.

Length, male 7.2 mm., female 7.5 mm. General color of dried material green. Triangle formed by metopidium above the bases of horns red brown, dorsal crest of same color. Lateral areas along each side of dorsal crest maculate with large white spots.

Pronotum very low, little arched, coarsely pitted; metopidium with sides parallel in frontal aspect; suprahumeral horns somewhat flattened dorsoventrally, acute apically, projecting slightly upward from horizontal, strongly recurved posteriorly; posterior process elongate, slender, not declivent.

Male with teeth on lateral valves suddenly convergent and narrowed in apical fourth. Sternal plate with deep, acute, V-shaped apical notch. Styles with apical portions divergent in basal fifth, very



gradually convergent in apical four-fifths. Posterior arm of aedeagus with lateral membranes forming a small hoodlike, subapical process where they converge on the anterior surface.

Last ventral segment of female with parabola-shaped notch in center of posterior margin almost as deep as segment.

Male holotype (U.S.N.M. No. 57642) and male paratype, Sioux County, Iowa, June 29, 1932 (Moore); female allotype, Story County, Iowa, July 5, 1932 (Russell); two male and one female paratypes, Ames, Iowa, July 4, 1919 (Ball); male and female paratype, Ames, Iowa, June 30 and July 28, 1897, respectively; male and female paratype, Clearmont, Iowa, August 3, 1929 (Rolfs); one male paratype, Mercer, Wis., 1910 (Chandler), and one, Toronto, Ontario, 1896 (Hills); male paratype, Lehigh Gap, Pa., July 20, 1902 (Greene); female paratype, Amery, Wis., September 14, 1917 (Ball); four female paratypes, Illinois, September 16, 1888; female paratype, Urbana, Ill., September 25, 1901; and one female paratype, Washington, D. C., July 2, 1917 (Taylor).

**STICTOCEPHALA BREVITYLUS DOLICHOTYLUS, new variety**

PLATE 21

Resembling the more slender examples of typical *brevitylus* (Van Duzee) but with the tylus elongate and only slightly curved posteriorly.

Length, male 8 mm., female 8.4 mm. Face yellow. Pronotum green mottled with yellow. Yellow color forming a broken irregular stripe along lateral ridges of metopidium and along dorsal crest. Horns tipped with black. An orange stripe present on ventral surface of either horn extending across pronotum to each eye.

Tylus elongate, slightly curved posteriorly. Metopidium not widening to suprahumeral horns as in typical *brevitylus*, less convex in dorsal aspect. Styles in male less abruptly bent at bases of apical portions in lateral aspect. Last ventral segment of female with deeper notch than in typical form.

Male holotype (U.S.N.M. No. 57643) and female allotype from Babylon, Long Island, N. Y., August 15, 1933 (Blanton), and a male and a female paratype from "New York."

All the known forms are listed below:

*abnorma*, new species

*albescens* (Van Duzee, 1908), new combination [*Ceresa*]

*basalis* (Walker, 1851) new combination [*Ceresa*]

*borealis* (Fairmaire, 1846), new combination [*Ceresa*]

*brevitylus* (Van Duzee, 1908), new combination [*Ceresa*]

*dolichotylus*, new variety

*brevicornis* (Fitch, 1856), new combination [*Ceresa*]

*brevis* (Walker, 1851), new combination [*Ceresa*]

*bubalus* (Fabricius, 1794), new combination [*Membracis*, *Centrotus*, *Ceresa*]



*curvata*, new species

*diceros* (Say, 1824), new combination [*Membracis*, *Smilia*, *Ceresa*]

*diminuta* Van Duzee, 1908

*lutea* (Walker, 1851)

*militaris* (Gibson and Wells, 1917), new combination [*Ceresa*]

*palmeri* (Van Duzee, 1908), new combination [*Ceresa*]

*stimulea* (Van Duzee, 1909), new combination [*Ceresa*]

*substriata* (Walker, 1851)

*taurina* (Fitch, 1856), new combination [*Membracis*, *Enchenopa*, *Ceresa*]

*illinoiensis* (Goding, 1894), new synonymy [*Ceresa*]

*tauriniformis*, new species

### TORTISTILUS, new genus

#### PLATE 18, FIGURE 6

In general resembling *Stictocephala* Stål but differentiated by having the metopidium more vertical and by having the styles of the males more flattened with their apices truncate or strongly convergent.

Suprahumeral usually prominent but usually unarmed. Metopidium almost vertical; the sides meeting before the middle of the body. Lateral valves with teeth; teeth shorter than width of valves. Male styles flattened in apical half, S-shaped; apices obliquely truncate or convergent. Aedeagus with functional orifice long, narrow, subapical; apex of posterior arm acuminate, needlelike in lateral aspect, appearing slightly flattened in caudal aspect.

Type of the genus, *Membracis goniphora* Say (1830, p. 243), known to occur over the northern section of the United States. The selection of *goniphora*, which is a synonym of *inermis* Fabricius, for type may be an unusual procedure, but it is believed to be the more logical choice since it is known that Say's material came from the Missouri region while it is only problematical that the Fabrician material may have come from northern North America. Furthermore, *goniphora* Say is the only large ceresine lacking suprahumeral horns other than *Membracis festina* Say recorded from the Missouri region, so it is reasonably certain that the specific identification of *goniphora* is correct even though its type is destroyed. In order to have a specimen upon which to base the specific concept of *goniphora* and the generic concept of *Tortistilus* it becomes necessary to designate a neotype for *Membracis goniphora* Say.

#### TORTISTILUS INERMIS (Fabricius), new combination

*Membracis inermis* FABRICIUS, 1775, p. 677.

*Membracis goniphora* SAY, 1830, p. 243.

Length 8.5 mm., greatest width 3.4 mm. General color of dried specimen dark yellow washed with green along suprahumeral and dorsal crest; lateral areas of pronotum spotted with white. Femora with dense black subapical areas; tibiae and tarsi lightly fumate.

Pronotum greatly elevated; metopidium perpendicular, widening to prominent rounded suprahumeral, the sides meeting before middle of body; posterior process gradually acuminate apically, strongly declivent, extending beyond the abdominal apex.

Lateral valves of males with teeth shorter than width of valves; teeth arising just dorsad to center of anterior margins of valves. Sternal plate with small apical notch. Styles long, S-shaped, appearing caliperlike in ventral aspect; apices flattened, truncate, minutely serrate. Aedeagus with posterior arm much more slender than anterior; functional orifice subapical, elongate-oval.

Description based on male neotype from Jefferson City, Mo., June 30, 1940 (Adams).

Members of *Tortistilus* are known to occur only in the Nearctic region, and as far as known their life cycles approximate those of *Stictocephala* in that the egg stage is passed upon a woody host and the immatures develop upon herbaceous plants. Many of the species are of economic importance in apple culture; *inermis* was reported as a major pest in the Pacific Northwest by Yothers, 1934.

Since the aedeagus in this genus is the same as that in *Stictocephala* it is possible that it should not be considered generically distinct; however, the styles of the two groups are very dissimilar and in general the thoracic profiles are very different, so the two groups are herein considered to represent two distinct genera.

The inclusion of *lateralis* (Funkhouser) and *trilineatus* (Funkhouser) in *Tortistilus* may be questioned because they differ from other species in this genus by slight differences in the aedeagus, styles, teeth on the lateral valves, pronotal profile, and the fact that they both occur on cypress. While it is recognized that the forms on cypress represent a distinct branch of *Tortistilus* it is believed that this branch is not far enough removed to be considered as generically distinct.

*T. inermis*, *collinus*, *pacificus*, and *wickhami* comprise a difficult but very interesting group. The apices of the styles in these forms are subject to considerable variation in form and size; however, this variation has a limited range for each species and as a whole the apices are very pertinent for specific diagnosis.

The variability of the styles in *inermis* received comment from Lawson, 1922, who illustrated (pl. 4, figs. 1, 5, 8) three different examples. Throughout the species it seems that specimens from one locality differ slightly from specimens of the same species from another locality with these differences being more pronounced in material from mountainous areas.

*T. minutus* is characterized by the low pronotum and by the tooth-like projection at the inner apical angle of the styles. *T. collinus* is readily separated from the related forms by the greatly suppressed suprahumeral and by the styles that are similar in form but larger

apically than those in *inermis*. *T. inermis* has a much broader metopidium than either *pacificus* or *wickhami* and is never black on the abdominal venter, whereas the two latter forms usually exhibit a tendency to be black beneath. The styles in *inermis* are not greatly enlarged apically and are minutely serrate. In *pacificus* and *wickhami* the styles are not minutely serrate and are greatly produced at the inner angles in *wickhami*; and in *pacificus* they are greatly enlarged apically and almost equally produced at the outer and inner angles.

*T. wickhami* is more northern in distribution than *pacificus* and its occurrence in California is probably determined by the higher elevations. *T. pacificus* is the commonest species in California, apparently replacing *inermis* in this State, which might suggest a subspecific relationship; it extends northward into southern Oregon and eastward through Nevada into Utah.

*T. albidosparsus* is separated from the other forms by having the suprahumeral developed into horns. The outer apical angles of the styles are acute and usually strongly produced. A form possessing very long horns and having the outer and inner apical angles of the styles strongly produced is described as a new variety.

TORTISTILUS MINUTUS, new species

PLATE 22

Superficially resembling *wickhami* (Van Duzee) but much smaller, with a lower pronotum and with the metopidium more rounded posteriorly.

Length, male 6.2 mm., female 6.6 mm. General color of dried specimens dark yellow mottled with irregular orange spots; coxae in the males blackened on outer side.

Pronotum low. Metopidium perpendicular on basal half, apical portion rounding posteriorly; the sides little widened before the suprahumeral, meeting at a point one-third the length of pronotum from anterior extremity. Posterior process very strongly declivent.

Male with teeth of lateral valves less than twice as long as broad, broadly rounded apically. Sternal plate laterally compressed in apical half to one-half of the basal width; apical fifth split, a small notch present at extreme apex. Styles long S-shaped; apices flattened, obliquely truncate, slightly serrate, outer and inner apical angles about equally produced with inner angle toothlike. Anterior arm of aedeagus greatly narrowed in apical third in either lateral or posterior aspect; functional orifice very broadly ovate.

Last ventral segment of female with posterior margin broadly emarginate, small V-shaped notch present in middle.

Male holotype (U.S.N.M. No. 57644), female allotype, one male paratype, and five female paratypes from "Montana," Uhler collection; one male paratype "Dac." (Dakota), Uhler collection.

## TORTISTILUS ALBIDOSPARSUS BUBALIFORMIS, new variety

## PLATE 22

Length, male 8 mm., female 8.8 mm.; width across horns approximating 4.7 mm. in either sex. Yellowish mottled with white. Horns tipped with black, with mahogany-colored stripes beneath not quite reaching humerals; short reddish stripe present on dorsoposterior margin; a white stripe separating the two dark red stripes on each horn continued onto the sides of the pronotum but fading before the ventral<sup>v</sup> margins of the pronotum.

Metopidium broad, slightly convex below horns, forming a broad flattened triangle between and posterior to horns. Horns recurved, acute.

Styles in male tending to be truncate with outer and inner apical angles equally produced into acute points.

Last ventral segment in female deeply notched in center of posterior margin; sides of notch sinuate.

Resembling *Stictocephala bubalus* (Fabricius) in general appearance but differentiated by the flattened apically truncate styles. Related to *T. a. albidosparsus* (Stål) but with longer horns and with the apical angles of the styles equally produced.

Male holotype (U.S.N.M. No. 57645), male paratype, and female allotype from Beaumont, Calif., June 23, 1941 (Christenson), on alfalfa; two male and two female paratypes from Oak Glen, Calif., August 29, 1939 (Christenson), on alfalfa; a male and female paratype from "Pasadena, Calif., 8-28"; and one male paratype from San Gabriel, Calif. (Hutchinson).

The forms occurring on cypress are a compact group comprising at least two distinct species and possibly several subspecies. The series of specimens are too short and the locality records are too limited to permit one to arrive at a definite conclusion as to whether these forms are subspecies replacing the typical forms in certain localities or whether they represent varieties. Since these forms are morphologically distinct but somewhat similar to the typical species they are herein considered to be varieties.

## TORTISTILUS TRILINEATUS CALIPERUS, new variety

## PLATE 22

Superficially resembling *T. t. trilineatus* (Funkhouser) but with a ratio of total length to length of pronotum as 7.1 is to 4.3; in *t. trilineatus* this proportion is 7.1 to 5.9.

Posterior process short, rather obtuse, very slightly declivent, equilaterally triangular in cross section. Styles of male angular, acute apically, strongly convergent, caliperlike. Last ventral segment of female almost as long as three preceding sclerites combined, notch in center of posterior margin extending almost to the base.

Male holotype (U.S.N.M. No. 57646) and male paratype from Sanford, Fla., June 9, 1926; two male paratypes same locality, July 8, 1926, female allotype and female paratype, June 17, 1947, and one female paratype, July 8, 1926 (Ball).

**TORTISTILUS TRILINEATUS CURVATUS, new variety**

PLATE 22

Ratio of total length to length of pronotum approximating that of *t. caliperus*, new variety. Posterior process more acute and more declivent, similar to *t. trilineatus* (Funkhouser), but differing from either by the truncate styles of the male.

Styles broad, flat, suddenly convergent apically; apices broadly truncate, slightly concave; inner margins produced subapically. Last ventral segment of female as long as three preceding sclerites combined; notch in center of posterior margin extending almost to base; basal half of notch acute, V-shaped; apical portion of notch widening to lateral margins of segment.

Male holotype (U.S.N.M. No. 57647) and six male paratypes from Concan, Tex., June 4, 1933 (Oman); paratype male, female allotype, and three female paratypes from Kerrville, Tex., June 9, 1907 (Pratt).

**TORTISTILUS TRILINEATUS SIMILIS, new variety**

PLATE 22

Form and proportion of *t. trilineatus* (Funkhouser) with an acute, deflected posterior process. Differing from the typical form by having the male styles somewhat apically convergent and truncate.

Styles in male convergent in apical tenth; apices truncate, slightly serrate. Last ventral segment of female as long as three preceding segments; sharp, V-shaped notch present in center of posterior margin half as deep as length of segment.

Holotype male (U.S.N.M. No. 57648), male paratype, female allotype, and five female paratypes from Pickens, Miss., July 16, 1921 (Drake); two male paratypes and one female paratype from Natchez, Miss., July 25, 1921 (Drake).

All the known forms are listed below:

*albidosparsus* (Stål, 1859), new combination [*Ceresa*]

*bubaliformis*, new variety

*collinus* (Van Duzee, 1908), new combination [*Stictocephala*]

*inermis* (Fabricius, 1775), new combination [*Membracis*, *Ceresa*, *Smilia*, *Stictocephala*]

*lateralis* <sup>4</sup> (Funkhouser, 1936), new combination [*Stictolobus*]

*minutus*, new species

*pacificus* (Van Duzee, 1908), new combination [*Stictocephala*]

<sup>4</sup> Since completion of this work, I have examined the type of *lateralis* from Horseshoe Lake, Ill., and find it to be a different species from the paratype in the U. S. National Museum.

*trilineatus* (Funkhouser, 1918), new combination [*Stictolobus*]  
*caliperus*, new variety  
*curvatus*, new variety  
*similis*, new variety  
*wickhami* (Van Duzee, 1908), new combination [*Stictocephala*]

**ANISOSTYLUS, new genus**

PLATE 19, FIGURE 8

Superficially resembling *Spissistilus*, new genus, but with a lower and broader metopidium with suppressed suprahumeralis suggestive of *Acutalis* Fairmaire.

Pronotum low; metopidium broader than high; suprahumeralis usually suppressed but if present (as indicated by slight swellings) then located very close to the humeral angles; posterior process greatly extended posteriorly on a line even with the apex of the apical cell in the forewing. Lateral valves broadly ovate with teeth longer than width of valves. Styles usually broad and curved dorsally but sometimes narrow, greatly elongate and strongly curved. Aedeagus with posterior arm simple, rounded apically, with functional orifice a broad slot extending from apex almost to base; attachment of posterior arm to anterior arm much above base of latter; anterior arm subequal in size to posterior arm, sometimes with an anterior plate making the total width greater than that of the posterior arm.

Type of the genus, *Stictocephala fulgida* Ball (1937, p. 480), from southern Arizona. *Stictolobus viridis* Funkhouser (1943) is herein considered to be a synonym of *fulgidus* (Ball) since there is nothing to differentiate the two forms and both have been collected in the same general locality. The type female of *Stictocephala gillettei* Goding very closely resembles the occasional female specimens of *Membracis festina* Say that have the suprahumeralis suppressed. Because it is impossible to determine the suggested synonymy definitely and a species of *Anisostylus* does occur in Colorado [type locality of *gillettei*] that is very similar, *gillettei* is considered a valid species. A form of *Anisostylus* occurring in New Mexico that is morphologically distinct from *fulgidus* is believed to be a subspecies, and a highly differentiated form occurring in Utah and Idaho is described as new. *Stictocephala elongata* Fowler (1895, p. 110), a Mexican species, may belong in *Anisostylus*.

**ANISOSTYLUS FULGIDUS ELONGATULUS, new subspecies**

PLATE 22

Differing from typical *fulgidus* (Ball) by the more elongate form, more angulate metopidium, and by the apices of the male styles rounding to the inner margins instead of rounding to the outer mar-

gins. Length, male 7.6 mm., female 7 mm. Specimens from preserving fluid, color unknown.

Thorax low; metopidium produced anteriorly before rounding posteriorly, slightly angulate toward center instead of evenly rounded in dorsal aspect; suprahumeral completely suppressed; humerals prominent; sides of pronotum sharply and deeply cut away just posterior to humerals; posterior process not strongly deflected.

Teeth on lateral valves of male, slender, convergent apically. Sternal plate with broad, shallow, apical notch; lobe on either side of notch broadly rounded. Styles very broad, flat, elongate, strongly curved dorsally, acute apically; outer margins of apices rounded to straight inner margins. Posterior arm of aedeagus gradually narrowed to rounded apex. Last ventral segment of female with broad U-shaped notch in center of posterior margin.

Male holotype (U.S.N.M. No. 57649) and female allotype from Espanola, N. Mex., August 29, 1940 (Christenson), and one female paratype, Santa Fe, N. Mex., "Oct. 4" (Cockerell).

ANISOSTYLUS STYLATUS, new species

PLATE 22

Resembling *fulgidus* (Ball) from which it is easily separated by its more robust form and long slender styles in the male.

Length, male 5.7 mm., female 6.2 mm. Pronotum dark green; apex of posterior process dark orange. Face and entire venter yellow, abdomen black above.

Thorax low; metopidium broadly transversely rounded; suprahumeral indicated by slight swellings; humerals prominent, obtuse; sides of pronotum behind humerals gradually and shallowly narrowed; posterior process reaching to a point in line with the posterior end of apical cells in elytra, strongly deflexed in male, less so in female.

Male with teeth of lateral valves acute apically. Sternal plate with sharp apical notch; lobes on either side of notch narrowly rounded. Styles slightly flattened, very elongate, strongly curved dorsally; apices acute, deflected caudally. Posterior arm of aedeagus gradually narrowed apically to rounded apex. Last ventral segment of female with broad, deep notch in center of posterior margin.

Holotype male (United States National Museum No. 57650), Avon, Utah, May 29, 1939 (Knowlton); female allotype, Laketown, Utah, April 11, 1935 (Sorenson); male paratype, Garland, Utah, September 4, 1935 (Knowlton), male paratype, Logan, Utah, September 7, 1906 (Ball), and male paratype, Ridale, Idaho, April 17, 1934 (Smith).

The forms known to occur in the United States are listed:



*fulgidus* (Ball, 1937), new combination [*Stictocephala*]  
*viridis* (Funkhouser, 1943), new synonymy [*Stictolobus*]  
*elongatulus*, new subspecies  
*gillettei* (Goding, 1892),<sup>5</sup> new combination [*Stictocephala*]  
*stylatus*, new species.

**SPISSISTILUS, new genus**

**PLATE 19, FIGURE 7**

Made up of species formerly included in *Ceresa* Amyot and Serville and *Stictocephala* Stål but differing from both genera by the reduction in size of the male styles and the highly modified aedeagus. The members of this group are relatively small compact species that have the suprahumeral prominent and frequently developed into small horns.

Pronotum low; suprahumeral usually very prominent, small horns sometimes present; metopidium broad, rounded transversely and posteriorly. Teeth on lateral valves as long as narrowest width of valves; arising near ventral margins of valves. Styles of male with apical portion broad, flat, slightly lunate; apices obtuse. Aedeagus usually with functional orifice apical; knob or flaplike extension present on apical margin above orifice usually small but sometimes greatly enlarged or variously modified.

Type of the genus, *Membracis festina* Say (1830, p. 243), originally described from Florida, is one of the most common, abundant, and well known species occurring in the southern sections of the United States. Several varieties have been established on characters of color and form of the suprahumeral, but these characters are gradational and do not warrant varietal consideration. The type specimen has been lost and a neotype is designated.

**SPISSISTILUS FESTINUS (Say), new combination**

*Membracis festina* SAY, 1830, p. 243.

Length 6 mm., width across suprahumeral 2.4 mm. General color of dried specimen deep orange with suprahumeral and dorsal crest light red.

Pronotum low, deeply pitted; metopidium widening to flaring suprahumeral, rounded posteriorly, sides meeting posterior to middle of body; suprahumeral very prominent; posterior process suddenly narrowed, elongate, acute apically.

Teeth of lateral valves arising from center of lower third of valves, flattened laterally, curved ventrally and convergent apically. Sternal plate with shallow apical notch. Apical portion of styles greatly flattened laterally, short, semilunate, obtuse apically. Posterior arm of aedeagus tubular in form, longer than anterior arm; small transverse apical flap present above functional orifice which opens apically.

Neotype male from Daytona, Fla., June 3, 1928 (Ball).

<sup>5</sup> *Viridis*, *nomen nudum*, an obvious error for *gillettei*. Goding (p. 11).

Within the species of this genus the suprahumeral in both sexes and the genitalia of the male are subject to small variations. *S. festinus* has an extensive range across southern United States and as far south as Costa Rica. The suprahumeral in this species are sometimes greatly suppressed or sometimes strongly developed, forming small horns. Horned individuals may be confused with *occidentalis*, but the development of the horns is never as pronounced as in *occidentalis* and the styles in *occidentalis* are slenderer and much more narrowed at midlength than in *festinus*.

For the present *franciscanus* is retained as a valid species since the thorax is lower, the methopidium more rounded, and the styles more serrate than in *festinus*. The interpretation of *franciscanus* is based on specimens determined by Van Duzee (1908, pp. 48, 49). *S. nigricans* seems to be a color variety of *franciscanus* since there are no consistent structural characters that will differentiate the two forms. It is interesting to note that *franciscanus* has been reported by Yothers (1941, p. 1) as ovipositing on orchard trees, while its close relative, *festinus*, according to Wildermuth (1915) completes its life cycle on alfalfa.

*S. rotundatus* may be a subspecies of *festinus* occurring in insular America as the two forms are very close; however, the styles in *rotundatus* are broadly sinuate on their dorsal margins while in *festinus* they are evenly arcuate.

*S. cornutus* is placed in this genus by the authority of Fowler's (1895, p. 110) observation as to the type of genitalia. This writer has seen one specimen that probably belongs to this species. Observations based on specimens from the Biologia Centrali-Americana material that are in the collection of the U. S. National Museum reveal that *fuscus* and *dubius* are color varieties of *festinus*.

*S. femoratus* has been reported ovipositing on orchard trees in the United States, but there are no specimens of this species in the U. S. National Museum collection from north of Mexico, D. F. Probably *uniformis* is conspecific with *femoratus*, but there is no evidence to substantiate this supposition other than the inadequate description by Fairmaire which indicates that it may be a color variety of *femoratus*. Accordingly, *uniformis* is provisionally retained as a valid species in this genus.

*S. constans*, as recognized from specimens from the type locality comparing favorably with the original description by Walker (1851, p. 563) and with the illustration by Knight (Funkhouser, 1923, pl. 3, fig. 1), is not represented in the collection of the U. S. National Museum by specimens collected west of Iowa. Typical *constans* is suddenly replaced in central and southern Texas by a form that has a different type of style but similar aedeagus. This form is believed to represent a new subspecies.

## SPISSISTILUS CONSTANS VARIANS, new subspecies

## PLATE 22

Resembling typical *constans* but with the styles in the male more slender and elongate and the notch in the center of the posterior margin of the female last ventral segment broader.

Teeth on lateral valves strongly convergent apically, acute; bases less abruptly bulbous than in typical form. Apical portion of styles almost as long as posterior arm of aedeagus, curved dorsally; apices narrowly rounded. Posterior arm of aedeagus with three pairs of subbasal teeth; one pair projecting ventrally from ventral lip of functional orifice, one pair slightly dorsad and well laterad to the teeth on the functional orifice projecting laterad, and one small pair dorsad to latter pair projecting laterad. Last ventral female segment with broader notch in center of posterior margin than typical *constans* (Walker).

Holotype male (U.S.N.M. No. 57651) and paratype male from Concan, Tex., June 4, 1933 (Oman); allotype female and three female paratypes from Brownsville, Tex., May 31, 1933 (Oman); female paratype and two male paratypes, Brownwood, Tex., May 29, 1941 (Christensen); male paratype, Dallas, Tex., June 10, 1905 (Yothers), and female paratype same locality, June 11, 1907 (Pierce); one female paratype, Hearne, Tex., June 21, 1912 (Coad); two male paratypes, Kerrville, Tex., May 30, 1906 (Pratt); one female paratype, Valley View, Tex., June 31 (Beck and Hall); and one male paratype and one female paratype, Victoria, Tex., May 18, 1907 (Mitchell).

The known forms of the Western Hemisphere are listed below:

- constans* (Walker, 1851), new combination [*Thelia*, *Ceresa*]
- varians*, new subspecies
- cornutus* (Fowler, 1895), new combination [*Stictocephala*]
- femoratus* (Fairmaire, 1846), new combination [*Ceresa*]
- festinus* (Say, 1830), new combination [*Membracis*, *Thelia*, *Stictocephala*]
- dubius* (Fowler, 1895) [*Stictocephala*]
- fuscus* (Fowler, 1895), new synonymy [*Stictocephala*]
- franciscanus* (Stål, 1859), new combination [*Ceresa*, *Stictocephala*]
- nigricans* (Van Duzee, 1915), new synonymy [*Stictocephala*]
- occidentalis* (Funkhouser, 1915), new combination [*Ceresa*]
- rotundatus* (Stål, 1869), new combination [*Stictocephala*]
- uniformis* (Fairmaire, 1846), new combination [*Ceresa*, *Stictocephala*]

## Genus STICTOLOBUS Metcalf

## PLATE 19, FIGURE 11

*Stictolobus* METCALF, 1916, pp. 1-3.

Heretofore confused with the forms of *Tortistilus*, new genus, that occur on cypress but separated from that genus by the great reduction of size in the apical half of the styles and by the aedeagus lacking an

anterior arm. This genus includes the small, slender species with the suprahumeral usually developed into horns; however, the type species has the suprahumeral unarmed.

Metopidium almost vertical. Teeth of lateral valves longer than length of valves, usually curved dorsally or convergent apically. Sternal plate short, lacking notch on ventral margin apically. Styles greatly reduced in size in apical half. Aedeagus with anterior arm vestigial or not apparent; posterior arm with anteriorly directed apical hook; functional orifice elongate, extending from apex of aedeagus half the distance to the base.

Type of the genus, *Membracis subulata* Say (1831, p. 378), a species from the United States. *Ceresa vitulus minor* Fowler, actually a valid species, as stated by Buckton (1903, p. 171), occurs in southern Texas, and it is probable that varieties and subspecies of it occur southward into British Guiana. The interpretation of *minor* is based on Biologia Centrali-Americana material in the U. S. National Museum from Teapa, Tabasco; a species and a subspecies, previously confused with *minor*, are described as new from the United States. According to determined material in the Ball collection, *minutus* (Funkhouser) is a synonym of *subulatus* (Say).

STICTOLOBUS BOREALIS, new species

PLATE 23

Resembling *minor* (Fowler) but with much flatter metopidium and much shorter and stouter horns.

Length, male 6.8 mm., female 7.5 mm. General color amber mottled with white spots. Apices of horns and posterior process black. Two white lines originating on posterior side of each horn and extending caudad; ventral line following ventral margin of pronotum; dorsal line arched, following the contour of dorsal crest but located ventrally to crest; the two lines converging and ending on ventral margin of pronotum anterior to posterior process. Elytra yellowish apically.

Thorax low, little arched; metopidium vertical below suprahumeral thence abruptly bent posteriorly above suprahumeral; humeral prominent; suprahumeral horns thick, obtuse, slightly recurved; posterior process long, declivent.

Teeth of lateral valves thickened in basal two-thirds; apical third stylate, abruptly curved dorsally. Sternal plate very deep apically; apex split. Apices of styles greatly reduced in size, paddle-shaped. Last ventral segment of female with posterior margin very broadly, deeply notched; sides of notch slightly sinuate.

Male holotype (U.S.N.M. No. 57652), two male paratypes, and one female paratype from Niobrara, Nebr., July 13, 1902 (Pierce); female allotype, two female paratypes, and male paratype from West Point, Nebr., "8-87"; two male paratypes from Rock County, Nebr.,

August 3, 1902, on oak (Pierce); and one female paratype, Carns, Nebr., July 24, 1902, on *Ambrosia* (Pierce).

**STICTOLOBUS BOREALIS ARCUATUS, new subspecies**

**PLATE 23**

Thorax much higher and more arched than in typical *borealis*. Teeth on lateral valves very suddenly narrowed in apical three-fifths and curved dorsally. Sternal plate shallow apically.

Male holotype (U.S.N.M. No. 57653) and paratype, Beeville, Tex., May 30, 1910 (Pierce).

The forms occurring within the United States are listed:

*borealis*, new species

*arcuatus*, new subspecies

*minor* (Fowler, 1895), new combination [*Ceresa*]

*subulatus* (Say, 1831)

*minutus* (Funkhouser, 1915), new synonymy [*Stictocephala*]

**VESTISTILUS, new genus**

**PLATE 19, FIGURE 10**

Intermediate between *Stictolobus* Metcalf and *Spissistilus*, new genus, in genital characters but differing from these genera by the over-all large size and by the short sternal plate which is greatly compressed laterally.

Pronotum highly arched; suprahumeral usually developed into long, stout horns but sometimes reduced to prominent protuberances; metopidium very broad. Lateral valves with teeth arising on ventral margins longer than length of valves; teeth flattened basally. Sternal plate compressed laterally, projecting ventrally. Styles vestigial or greatly reduced in apical half. Aedeagus with arms almost at right angle to each other; posterior arm much more elongate than anterior with the apex recurved or hooked anteriorly; sometimes with a pair of small basal spines; functional orifice subapical, small, ovate.

Type of the genus, *Ceresa ancora* Ball (1937, p. 479), a species from southern Arizona. As far as known this genus is limited primarily to Mexico and Central America. *Ceresa curvicornis* Funkhouser (1942, p. 181), described from a single female specimen from Arizona, is included because of its large size, broad metopidium, and strongly developed horns which are strongly suggestive of *ancora* Ball. A study of Biologia Centrali-Americana material in the collection of the U. S. National Museum indicates that *nigrovittatus* (Fowler) and *variabilis* (Fowler) belong in this genus. *V. vacca* (Fowler) is the common species in Mexico, according to Plummer (1935, p. 374), on authority of determinations by Funkhouser, but the most abundant form in the U. S. National Museum collection has been determined as *testaceus* (Fairmaire). This includes specimens from the Biologia

Centrali-Americana material determined by Fowler, and one specimen determined by Signoret. It would seem that either *testaceus* (Fairmaire) is unknown, that *vacca* is a synonym of *testaceus*, or that *mexicanus* (Plummer) is a synonym of *vacca*, but without examination of all the types it is impossible to settle this problem. It is best, therefore, that the species be retained as valid for the present.

The styles, though much reduced in size in this genus, still retain good specific characters which are best diagnosed by reference to the illustrations. (Pl. 19, fig. 10; pl. 23.)

The forms known to belong to this genus are listed.

*ancora* (Ball, 1937), new combination [*Ceresa*]  
*curvicornis* (Funkhouser, 1942), new combination [*Ceresa*]  
*mexicanus* (Plummer, 1935), new combination [*Ceresa*]  
*nigrovittatus* (Fowler, 1895), new combination [*Ceresa*]  
*testaceus* (Fairmaire, 1846), new combination [*Ceresa*]  
*vacca* (Fowler, 1895), new combination [*Ceresa*]  
*variabilis* (Fowler, 1895), new combination [*Ceresa*]

#### TRICHAETIPYGA, new genus

##### PLATE 19, FIGURE 9

Related to *Stictolobus* Metcalf with which it agrees in the small size and slender form but differs in the tripartite aedeagus.

Pronotum high, suprahumeral usually prominent and often developed into small acute horns. Lateral valves reduced to small membranous areas lacking teeth. Posterior margin of pygofer with paired processes on either side; a very short process on the apical fourth and an elongate projection at about the center of the posterior margin. Apical portion of styles vestigial. Aedeagus modified to form three arms with the ventroposterior arm bifurcate apically, bifurcate processes recurved laterally; central arm (or, normally, posterior arm) long, slender, sometimes with anteriorly directed apical hook; anterior arm short and broad in lateral aspect, sometimes much reduced in size.

Type of the genus, *Stictolobus juniperinus* Ball (1937, p. 481), a species from Arizona. As far as known only two other described species belong in this genus, *Ceresa infantilis* Ball (1937) from Guerrero, Mexico, and *Stictolobus delongi* Plummer (1943) from Morelos, Mexico. The ventroposterior arm of the aedeagus is very long in *juniperina* and extremely short in *delongi*. *T. infantilis* has a pair of anteriorly directed hooks on the central arm of the aedeagus (normal anterior arm) which the other two species lack.

The known forms are listed:

*delongi* (Plummer, 1943), new combination [*Stictolobus*]  
*infantilis* (Ball, 1937), new combination [*Ceresa*]  
*juniperina* (Ball, 1937), new combination [*Stictolobus*]

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#### ABBREVIATIONS USED ON PLATES

Each illustration bears the name of the species and is accompanied by key letters designating the structure that is illustrated. The key is as follows:

A=Aedeagus; left lateral aspect.

C=Aedeagus with style attached; left lateral aspect.

G=Genital capsule; left lateral aspect.

L=Style; left lateral aspect, usually of apical portion only.

O=Aedeagus; dorsal aspect of ventroposterior arm.

P=Aedeagus; posterior aspect, sometimes of apical portion only.

T=Tooth of lateral valve; left lateral aspect except *festinus*, which is from the posterior aspect.

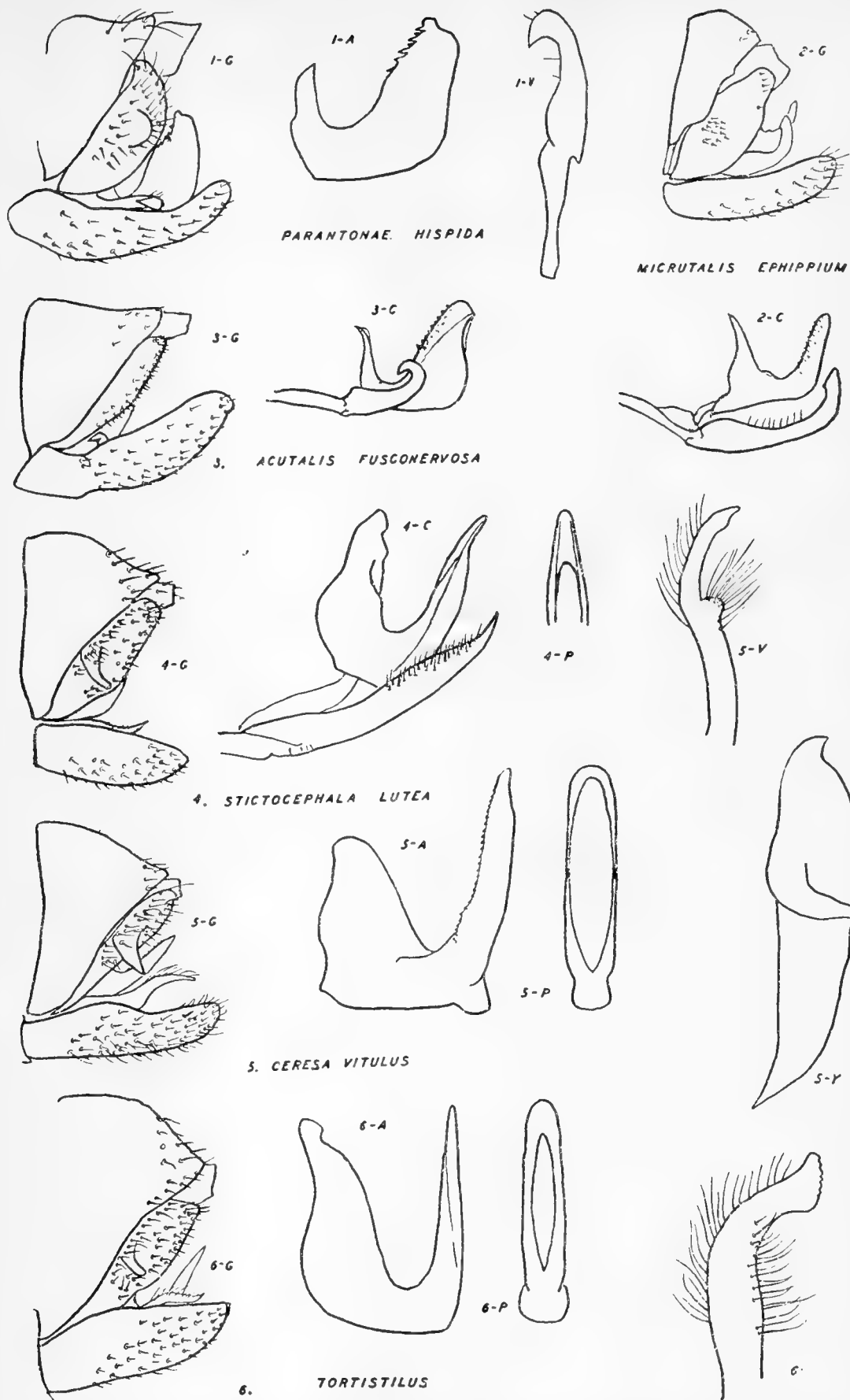
V=Style; left ventral aspect, usually apical portion only.

Y=Lateral valve; left lateral aspect, sometimes with pygofer included.

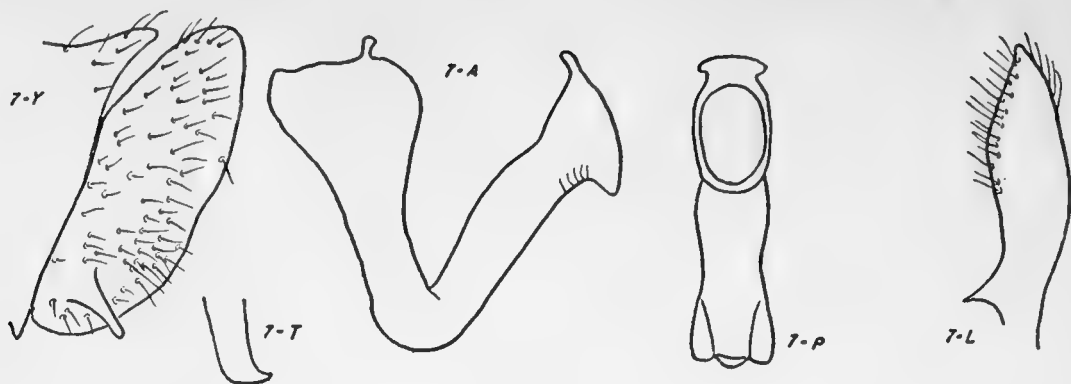
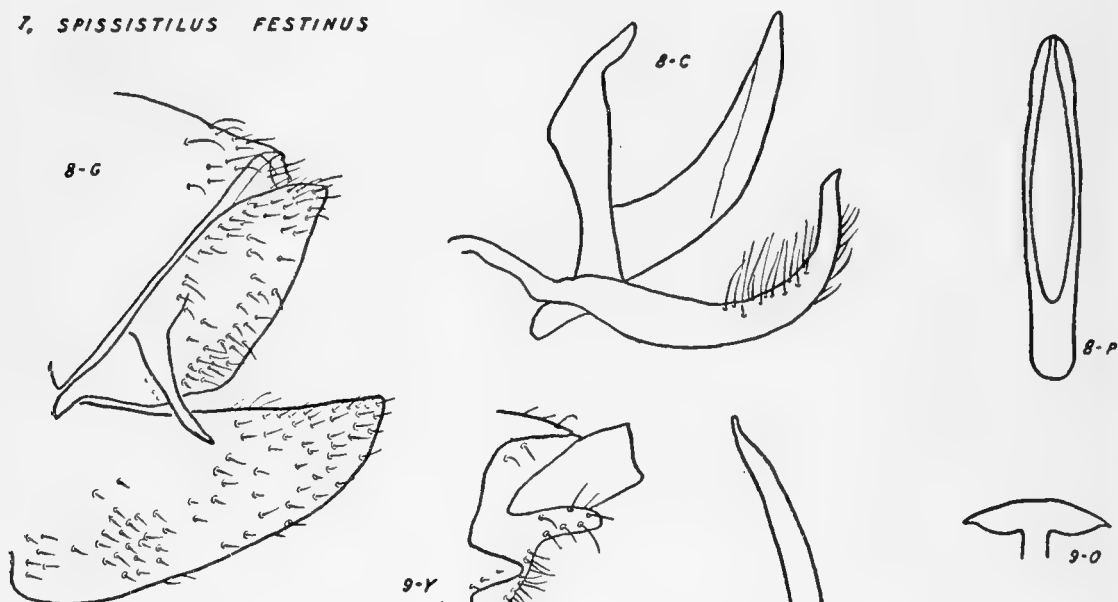
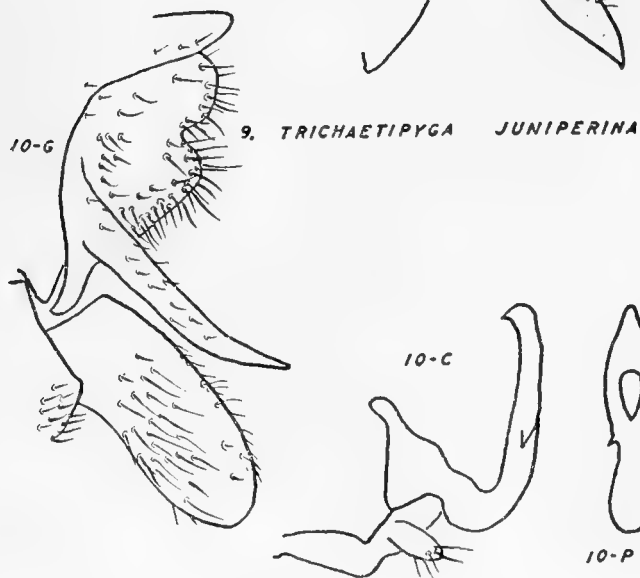
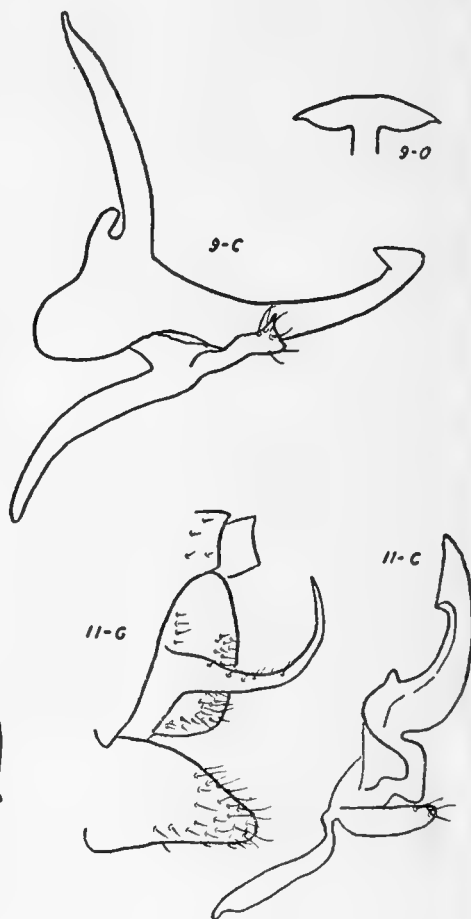
The first of these is the fact that the United States is a young nation, and its history is therefore a history of growth and development. The second is the fact that the United States is a large nation, and its history is therefore a history of expansion and conquest. The third is the fact that the United States is a diverse nation, and its history is therefore a history of conflict and compromise.

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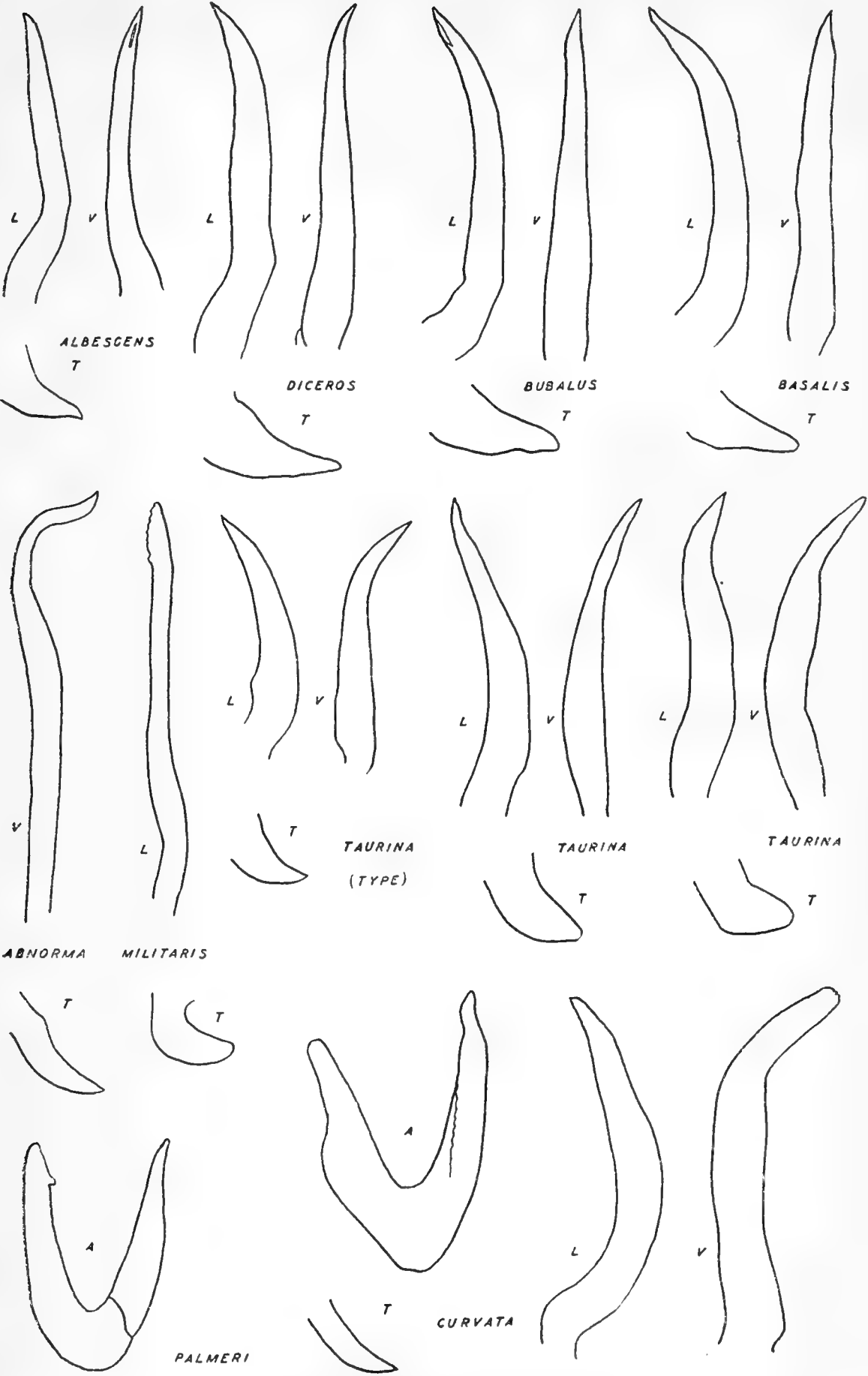
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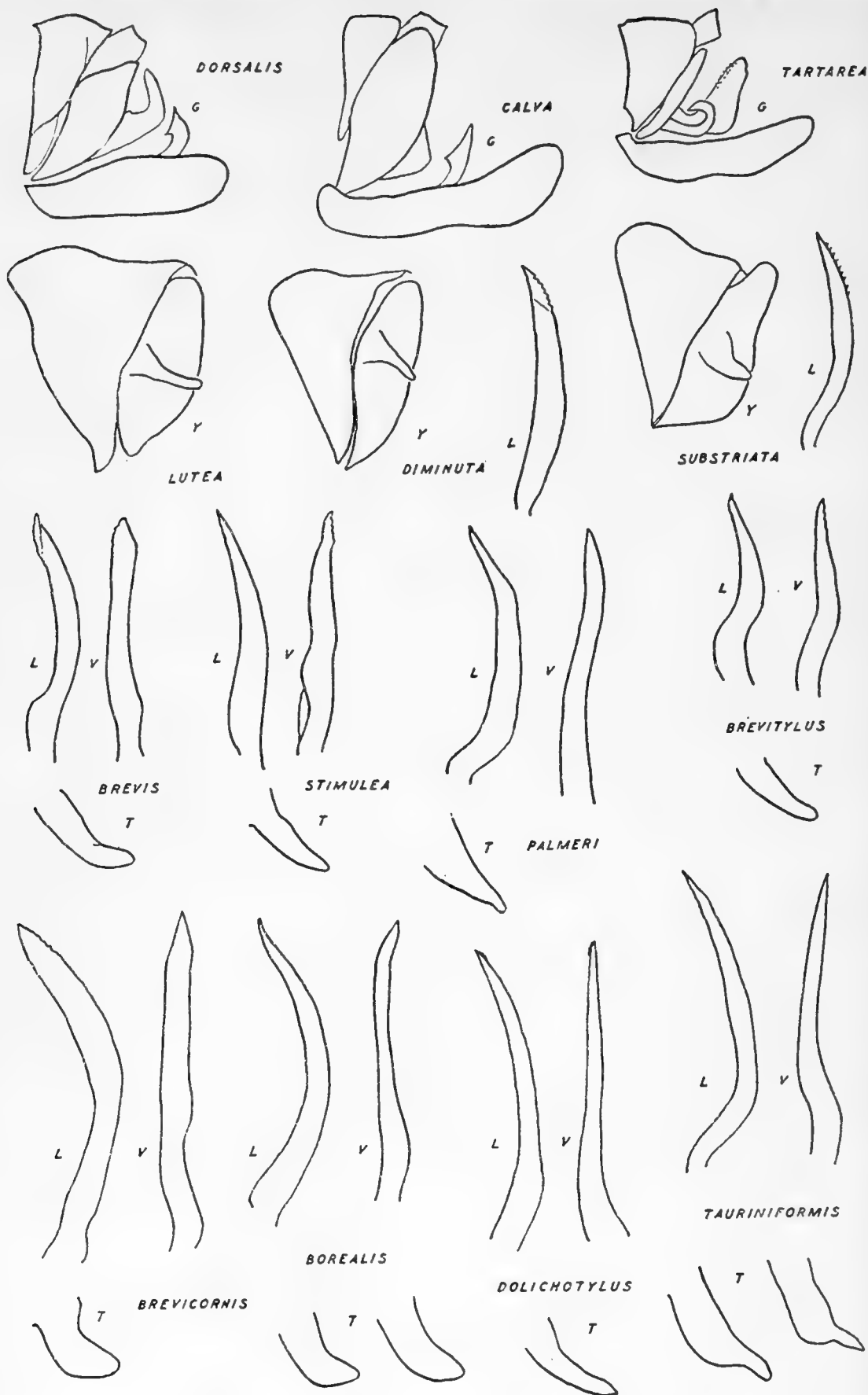
Genitalia of genotype species (*hispida* excepted): 1, *Parantonae hispida* Van Duzee; 2, *Microtalis ephippium* (Burmeister); 3, *Acutalis fusconervosa* Fairmaire; 4, *Stictocephala lutea* (Walker) (4-C and 4-P through courtesy of Dr. W. E. China); 5, *Ceresa vitulus* (Fabricius); 6, *Tortistilus inermis* (Fabricius).

7. *SPISSISTILUS FESTINUS*8. *ANISOSTYLUS FULGIDUS*9. *TRICHAETIPYGA JUNIPERINA*10. *VESTISTILUS ANCORA*11. *STICTOLOBUS SUBULATUS*

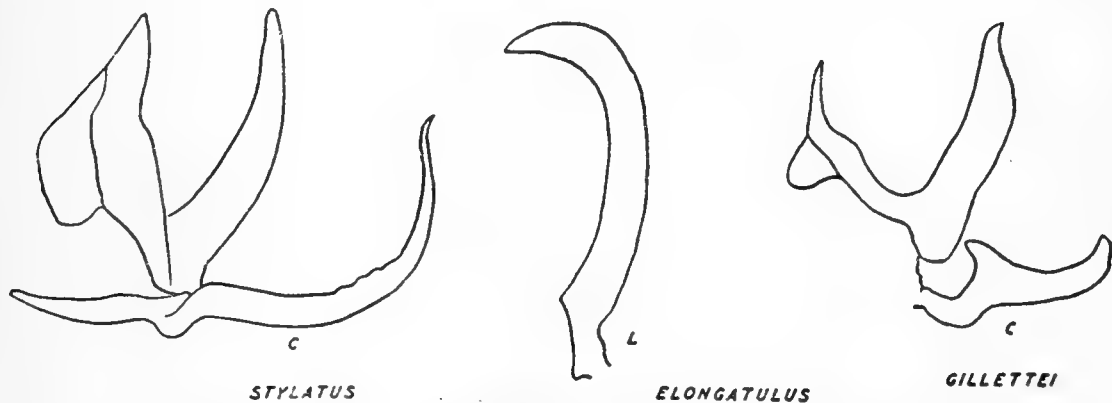
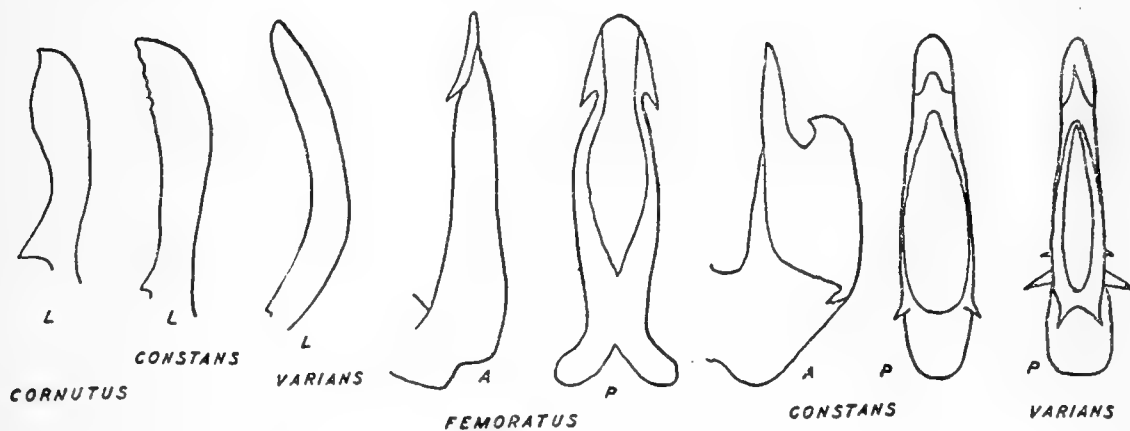
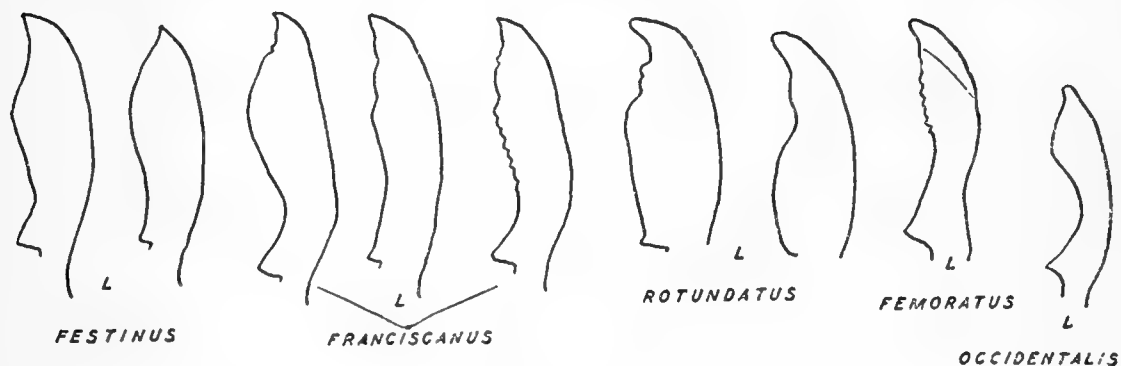
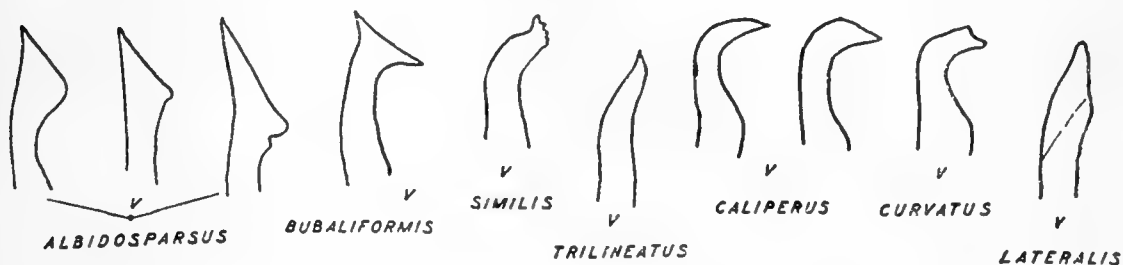
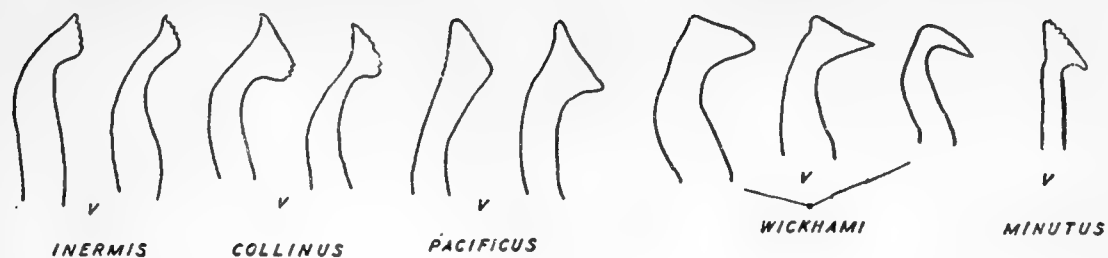
Genitalia of genotype species: 7, *Spissistilus festinus* (Say); 8, *Anisostylus fulgidus* (Ball); 9, *Trichaetipyga juniperina* (Ball); 10, *Vestistilus ancora* (Ball); 11, *Stictolobus subulatus* (Say).

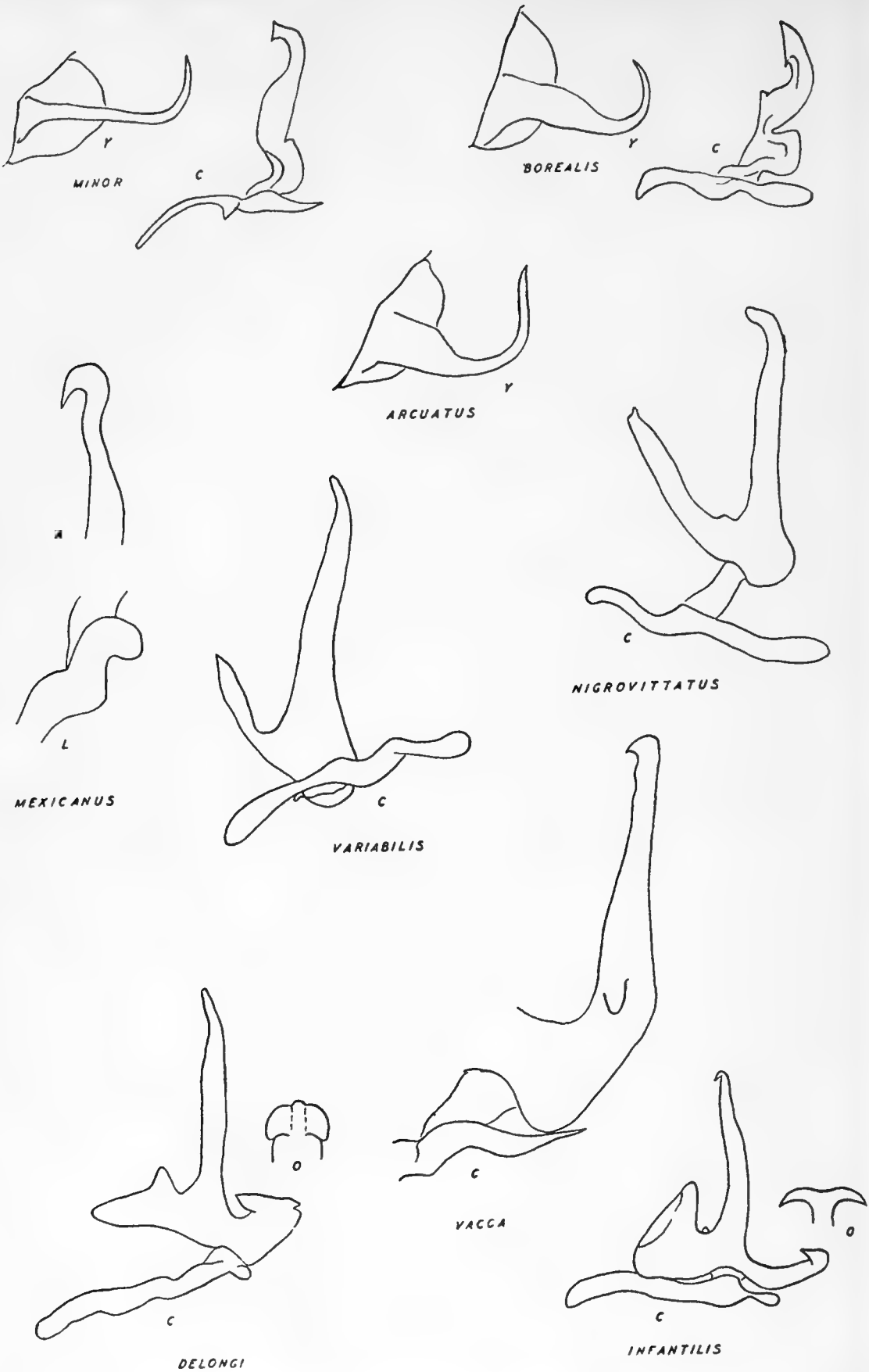


Genitalia of species of *Stictocephala*.

Genitalia of species of *Micrutalis*, *Acutalis*, and *Stictocephala*.



Genitalia of species of *Tortistilus*, *Spissistilus*, and *Anisostylus*.



Genitalia of species of *Stictolobus*, *Vestistilus*, and *Trichaetipyga*.

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